ENVIRONMENTAL IMPACT ANALYSIS PROCESS

ENVIRONMENTAL ASSESSMENT
SPACE TEST EXPERIMENTS PLATFORM
MISSION 1
VANDENBERG AIR FORCE BASE, CA
5 JANUARY 1994

DEPARTMENT OF THE AIR FORCE

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FINDING OF NO SIGNIFICANT IMPACT (FONSI)
ENVIRONMENTAL ASSESSMENT
SPACE TEST EXPERIMENTS PLATFORM MISSION 1
VANDENBERG AIR FORCE BASE, CALIFORNIA

AGENCY: United States Air Force (USAF), Headquarters space and Missile Systems Center (HQ SMC), Environmental Management Division (CEV)

COOPERATING AGENCY: Department of Defense (DOD) Space Test Program (STP)

BACKGROUND: Pursuant to the National Environmental Policy Act (NEPA) of 1969, the Council on Environmental Quality regulations implementing the Act (40 CFR Parts 1500-1508), DOD Directive 6050.1, Air Force Regulation 19-2, which implements these regulations in the Environmental Impact Analysis Process (EIAP), and other applicable Federal and local regulations, the USAF has conducted and assessment of the potential environmental consequences of the proposed implementation of the Space Test Experiments Platform Mission 1 (STEP M1) Program and alternatives.

PROPOSED ACTION: The DOD STP proposes to launch the STEP M1 spacecraft from Vandenberg Air Force Base (VAFB), California. STP is procuring a space vehicle based on an adaptable spacecraft bus to support numerous STP experiments. The overall goal of the STEP program is to support DOD in obtaining vitally needed scientific data about space and the earth’s environment by creating low-cost, lightweight, standardized satellites for science payloads. The payload for this first mission of STEP consists of four DOD experiments, each designed to research different facets of the atmosphere. Once analyzed, this data will promote technological advances in high frequency communications, atmospheric modeling for aircraft and spacecraft, and provide possible insight into the prediction of geophysical phenomena such as earthquakes.

The space launch vehicle planned to launch the STEP M1 is the Air Force Small Launch Vehicle (AFSLV), known commercially as the Pegasus XL. The standard Pegasus launch vehicle and associated activities for placing the satellites in orbit have been evaluated in the AFSLV Environmental Assessment (EA) (May 1991) and the Pegasus EA (October 1989). The launch vehicle processing and integration facilities (Building 1555 and Hot Pad Loading Area) at VAFB were previously evaluated in the Orbital Sciences Corporation (OSC) Commercial Launch Services Program EA (March 1993). These facilities will be used to support the proposed action. A FONSI was approved for each of these actions. The EA for the proposed action updates and supplements the evaluation in these previous documents as necessary to complete the environmental analysis.

The STEP M1 launch will be the first flight of the AFSLV, and STEP M1 would be the only payload on this launch. The AFSLV would be carried aloft by an OSC-modified Lockheed L-1011 passenger aircraft, which would take off from the existing airfield on North VAFB. An F-16 chase aircraft, originating from Edwards Air Force Base, California, will be used for visual observations to improve flight safety.

It is a mission requirement to fly four DOD experiments in a 80° inclination polar orbit at specified altitudes to collect data on ionospheric propagation phenomena and obtain measurements of upper atmospheric composition and dynamic processes. The high inclination is needed to allow coordination between spacecraft receivers and various ground transmitters. The on-board propulsion system will provide orbit maintenance, since the low perigee (point in the satellite's orbit that is nearest the earth) will result in significant drag and continually lower the orbit energy. Existing USAF remote tracking stations around the world will be used to gather data from the satellite. STEP M1 has a planned operational life of 6 to 12 months. At the end of its operational life, all on-board fuel will be consumed, the orbit will decay, and the satellite will re-enter the atmosphere.

The proposed action involves the processing and launch of the STEP M1 spacecraft at VAFB. The STEP M1 program would include the use of three existing facilities on North VAFB:

- Building 1555 (Vehicle Integration Facility) for mission processing,
- the Pegasus Hot Pad Loading Area, and
- the airfield for takeoff and landing of the L-1011 aircraft.

ALTERNATIVES TO THE PROPOSED ACTION: As required by NEPA, HQ SMC considered other alternatives to the proposed action. There are no other available launch vehicles or combinations of systems in the U.S. inventory that can fulfill mission requirements of the STEP M1. Use of the limited payload opportunities on existing Titan, Atlas and Delta launch vehicles would place additional requirements on schedules, planning, and availability, and may result in the inability to carry out the STEP M1 mission as planned. Use of these launches would place small payloads in suboptimum orbits with larger payloads, adding unacceptable risk to satellite performance. Other vehicle or program concepts submitted as AFSLVs are not alternatives because they have not been developed and are not available.

A variety of launch sites were initially considered. Previous Pegasus missions have been flown from the National Aeronautics and Space Administration (NASA) Dryden Flight Test Facility at Edwards Air Force Base. Each of these missions have used, and will use, a NASA B-52 aircraft as the launch platform. There are two Pegasus missions remaining. Use of the Dryden Flight Test Facility ids not possible for STEP M1 because NASA has decided to no longer support other commercial endeavors after the last Pegasus mission is flown. The Dryden facility will no longer support OSC activities after 1994. For these reasons, the only site considered is VAFB. This site has been approved for this program by the Air Force.

Use of a B-52 aircraft for the STEP M1 launch is not possible because the longer and heavier Pegasus XL was not designed or manufactured to be carried by the B-52. OSC has made the decision to depart from use of the NASA aircraft in favor of a completely commercial L-1011 carrier aircraft.

Although the AFSLV may be launched from Wallops Island or the Eastern Range at some later date, the specific mission of the STEP M1 requires and inclination for the orbit that is higher (80°) than would be possible from the Eastern Range (39° to 57°) or from Wallops Island off the coast of Virginia. Therefore, these sites are not being considered as alternatives to STEP M1 launch at this time.

HQ SMC also considered the no action alternative. If the STEP M1 program is not implemented as planned, DOD would not be able to fulfill the mission requirement. Under the no action alternative, it would not be possible to obtain the scientific and experimental data required for mission accomplishment. Specifically, there is no other alternative to this proposed method of collecting the atmospheric and ionospheric data. Each of the experiments would obtain unique data that can only be collected in space, in a low-earth orbit, and at the specific altitudes and atmospheric conditions required for each experiment. There are no other space experiments planned to gather this data in the areas needed to support DOD atmospheric and ionospheric models. It was therefore determined that the no action alternative would not meet mission requirements.

The Air Force has considered all of the above alternatives, and has selected the proposed action as the preferred alternative.

SUMMARY OF FINDINGS: The EA evaluated the environmental impacts at VAFB, with regard to the STEP M1 ground processing and launch at VAFB, in-orbit operation, and orbital decay and reentry. The following environmental areas were assessed for environmental effects in this EA: air quality, global climate change and stratospheric ozone depletion, waste management, noise, public services, utilities and transportation, socioeconomics, hydrology and water quality, natural resources, energy, visual resources, and safety and risk. Because the proposed action does not include the construction of any new ground facilities, the topics of biological resources, cultural resources, coastal resources, and soils and geology have not been evaluated.

Activities conducted in support of satellite processing and launch at VAFB including forklift unloading, alcohol wipedown, hydrazine transfer, assembly truck transfer, hydraulic lift for attachment, and takeoff and landings of the L-1011 and F-16 aircraft, will result in emissions to the atmosphere. Since these emissions are minor in quantity, and generated during a very short period of time at a location that is isolated from the general public, the impact to air quality is considered insignificant.

The emissions of greenhouse and ozone-depleting compounds from the STEP M1 launch will affect the atmospheric concentrations of these compounds. However, the significance of the launch impact is small.

Minimal amounts of hazardous and nonhazardous waste will be generated over a short period of time during satellite processing. All hazardous materials, including the hydrazine fuel, will be handled in accordance with applicable federal, state, and local regulations and safety plans.

STEP M1 processing and launch operations will not produce significant noise levels.

No new community facilities or services will be required for the proposed action. Transportation services and traffic will not be significantly affected, due to the limited number of personnel required for on-base processing and launch operations.

Socioeconomic resources, including populations, housing, and employment, will not be adversely affected by STEP M1 processing and launch at VAFB. The additional 20 personnel required for the proposed action will be only temporary.

Facility renovations have already been performed in support of processing activities at VAFB. No significant impacts on hydrology and water quality are anticipated. Water use required to support the temporary personnel during processing activities will be minimal.

Natural and visual resources at VAFB will not be affected by the proposed action.

Energy requirements of the STEP M1 project are minimal, and not considered significant.

Identified safety concerns have been considered in planning for STEP M1 processing at VAFB. Safety procedures have been developed, reviewed, and approved. Final risk levels are considered acceptable.

A review of the regulatory requirements indicated that no permits will be required for the proposed action.

No significant environmental impacts are expected as a result of ground processing and launch at VAFB, in-orbit operation, and orbital decay and reentry of the STEP M1. Potential impacts are either not anticipated, or may occur at less than significant levels. No mitigation measures are required for the proposed action.

POINT OF CONTACT: A copy of the STEP M1 FONSI and EA, 5 January, 1994, may be obtained from, or comments on these documents may be submitted to:

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ENVIRONMENTAL ASSESSMENT
for
SPACE TEST EXPERIMENTS PLATFORM
MISSION 1

VANDENBERG AIR FORCE BASE, CALIFORNIA

Prepared for

HEADQUARTERS SPACE AND MISSILE SYSTEMS CENTER/CEV
DIRECTORATE OF ACQUISITION CIVIL ENGINEERING
LOS ANGELES AIR FORCE BASE, CALIFORNIA

and

ARMSTRONG LABORATORY/OEB
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ACRONYMS AND ABBREVIATIONS

ADMS	Atmospheric Density Mass Spectrometer
ADS	Atmospheric Density Specification
AFR	Air Force Regulation
AIT	Assembly Integration Trailer
AFSLV	Air Force Small Launch Vehicle
AMA	Agricultural Management Areas
AMS	American Meteorological Society
ARAR	Accidental Risk Assessment Report
CAAQS	California Ambient Air Quality Standards
$CaCO_3$	Calcium carbonate
CADS	Composition And Density Sensor
CAP	Collection Accumulation Point
CCD	Coastal Consistency Determinations
CCR	California Code of Regulations
CDHS	California Department of Health Services
CFCs	chlorofluorocarbons
cfh	cubic feet per hour
CFR	Code of Federal Regulations
cfs	cubic feet per second
CH_4	methane
CHAMPION	Coordination of Heating And Modification Processes into the Ionosphere
$C1_2$	elemental chlorine
$C1^-$	chlorine radical
CMP	Coastal Management Plan
CNEL	Community Noise Equivalent Level
CO	carbon monoxide
CO_2	carbon dioxide
dBA	A-weighted sound level
dB	decibels

DOD	Department of Defense
DOPAA	Description of the Proposed Action and Alternatives
DSI	Defense Systems, Inc.
DUCTED	Ducted Wave Propogation Experiment
EA	Environmental Assessment
EIAP	Environmental Impact Analysis Process
EPA	Environmental Protection Agency
FONSI	Finding of No Significant Impact
GCMs	General Circulation Models
gpd	gallons per day
H_2O	water
HC	hydrocarbons
HCl	hydrogen chloride
HF	high frequency
HMPP	Hazardous Material Pollution Prevention
IR	infrared
kg	kilograms
km	kilometers
kVA	kilovolt ampere
kV	kilovolt
lbs	pounds
L_{eq}	average noise level
L_{max}	maximum noise level
LUSD	Lompoc Unified School District
µCi	microcurie
M1	Mission 1
MIL-STD	Military Standard
MRMP	Mineral Resource Management Plan
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NiCd	nickel cadmium

nm	nautical miles
N_2H_4	hydrazine
N_2O	nitrous oxide
NO_2	nitrogen dioxide
NO_X	nitrogen oxides
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
O_2	molecular oxygen
O_3	ozone
OMCF	Orbiter Maintenance and Checklist Facility
OSC	Orbital Sciences Corporation
PEA	Plasma Environment Analyzer
PG&E	Pacific Gas & Electric
PSCs	polar stratospheric clouds
psia	pounds per square inch atmospheric
psig	pounds per square inch gage
PM_{10}	particulate matter less than or equal to ten microns
ppm	parts per million
Ra	radium
RCRA	Resource Conservation and Recovery Act
RWQCB	Regional Water Quality Control Board
RWWRP	Regional Waste Water Reclamation Plant
SB	Senate Bill
SBCAPCD	Santa Barbara County Air Pollution Control District
SCAPE	Self-Contained Atmospheric Pressure Ensemble
SETA	Satellite Electrostatic Triaxial Accelerometer
SO_2	sulfur dioxide
SO_X	sulfur oxides
SRM	Solid(-propellant) Rocket Motor
STEP M1	Space Test Experiments Platform Mission 1
STP	Space Test Program
STS	Space Transportation System

TSDF	Treatment, Storage and Disposal Facility
ug/m^3	micrograms per cubic meter
USAF	United States Air Force
USC	United States Code
UV	ultraviolet
VAFB	Vandenberg Air Force Base
WSMCR	Western Space and Missile Center Regulation

SECTION 1

PURPOSE OF AND NEED FOR THE ACTION

SECTION 1

PURPOSE OF AND NEED FOR THE ACTION

1.1 BACKGROUND

The Department of Defense (DOD) Space Test Program (STP) proposes to launch the Space Test Experiments Platform Mission 1 (STEP M1) spacecraft from Vandenberg Air Force Base (VAFB), California.

STEP M1 requires completion of Environmental Impact Analysis Process (EIAP). The EIAP is contained in Air Force Regulation (AFR) 19-2 which describes the procedural requirements for implementation of the National Environmental Policy Act (NEPA) of 1969 (Public Law 91-190, 42 USC 4321) and the President's Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500 through 1508). The Air Force Form 813 containing the preliminary Description of the Proposed Action and Alternatives (DOPAA) is presented in Appendix A of this document.

The standard Pegasus launch vehicle and associated activities have been evaluated in the Air Force Small Launch Vehicle (AFSLV) Environmental Assessment (EA) (USAF, 1991) and the Pegasus EA (USAF, 1989a and 1990). An EA has also been completed for the launch vehicle processing and integration facilities at VAFB (Building 1555 and Hot Pad Loading Area), and the Pegasus XL launch vehicle (OSC, 1993b), which will be used to support the proposed action. A Finding of No Significant Impact (FONSI) was approved for each of these actions. This EA updates and supplements the information in these previous documents, as necessary, to complete the environmental analysis for the proposed action. A supplementary analysis of several issues is included in this EA to meet the level of analysis required under Air Force and DOD standards, and to reach a conclusion on potential environmental effects of the proposed action.

1.2 PROGRAM DESCRIPTION

The overall goal of the STEP program is to support DOD in obtaining vitally needed scientific data about space and the earth's environment by creating low-cost, lightweight, standardized satellites for science payloads. STP is procuring a space vehicle based on an adaptable spacecraft bus to support numerous STP experiments. The payload for this first mission of STEP consists of four DOD experiments, each designed to research different facets of the atmosphere. Once analyzed, this data will promote technological advances in high frequency communications, atmospheric modeling for aircraft and spacecraft, and provide possible insight into the prediction of geophysical phenomena such as earthquakes. Existing U.S. Air Force (USAF) remote tracking stations around the world will be used to gather data from the satellite.

1.3 PURPOSE OF THE ENVIRONMENTAL ASSESSMENT

The purpose of this EA is to make the decision maker(s) aware of the environmental consequences of the proposed action and alternatives, including the no action alternative. The EA contains the environmental documentation used by the decision maker(s) for selection and approval of the proposed action or an alternative.

1.4 ISSUES

The most significant issues of the proposed action are air quality, effects on global climate change, space debris, safety, and waste management. These major issues have been subject to careful evaluation in this EA. Other issues evaluated in this document, but considered minor, are noise, public services, utilities and transportation, socioeconomics (population, housing and employment), hydrology and water quality, natural resources, energy, and visual resources. Because the proposed action does not include the construction of any new ground facilities, the topics of biological resources, cultural resources, coastal resources, and soils and geology have not been evaluated in this EA. These subjects were evaluated as appropriate in previous environmental documentation for new or modified facilities to be used for this program (OSC, 1993b). The analyses completed for air quality (launch operations), global climate change, stratospheric ozone depletion, noise, and energy supplement and update information presented in the previous environmental documents prepared for the launch vehicle and ground support facilities. These subjects were either not analyzed in the previous documents, not analyzed for specific components required with the proposed action, or not analyzed at a level of detail sufficient to meet Air Force and DOD standards.

1.5 SCOPE OF THIS ENVIRONMENTAL REVIEW

This EA has been prepared to satisfy the environmental review requirements set forth in NEPA, and in accordance with the President's Council on Environmental Quality regulations implementing the Act (40 CFR Parts 1500-1508) and Air Force Regulation (AFR) 19-2 (EIAP, August 10, 1982). The objective of this EA is to form a basis for determining the significance of environmental impacts which would result from implementation of the proposed action and alternatives.

Following this review, the Air Force will approve the determination of whether or not the preferred alternative will have a significant effect on the human environment, and whether or not the preferred alternative will be the subject of (i.e., require) an Environmental Impact Statement (EIS). If the environmental analysis indicates that the preferred alternative will not result in a significant effect on the environment, or that potentially significant impacts can be mitigated to a level of insignificance, then a FONSI will be prepared, reviewed and approved by the Air Force.

This EA will focus on the potential impacts in the major issue areas of air quality, global climate change, waste management and safety that could result from ground

processing and launch of the STEP M1 satellite at VAFB using a Pegasus XL launch vehicle mounted on an L-1011 carrier aircraft, in-orbit operation, and orbital decay and reentry. Ground processing includes cleaning, testing, and loading liquid propellant onto the satellite.

SECTION 2

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

SECTION 2

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

2.1 PROPOSED ACTION

The Department of Defense (DOD) Space Test Program (STP) proposes to launch the Space Test Experiments Platform Mission 1 (STEP M1) spacecraft from Vandenberg Air Force Base (VAFB), California.

2.2 PROJECT LOCATION

Vandenberg Air Force Base occupies 98,147 acres along the south-central coast of California and is located approximately 140 miles northwest of Los Angeles (see Figure 2-1). West Ocean Avenue bisects the Base into North VAFB and South VAFB (see Figure 2-2). The STEP M1 program would utilize facilities on North VAFB.

Launches from the Pacific coast location of VAFB are within the Western Range, which permits space launch azimuths (horizontal direction from a zero degree at geographic north) with polar and other high inclination (angle between zero at horizontal and 90 degrees at vertical) orbits (see Figure 2-3). Polar orbits provide coverage of the entire planet perpendicular to the equator. These orbits may be required for scientific study, weather and earth resources surveillance, communications relay, navigational systems, and defense purposes. Another type of high inclination mission is the sun-synchronous mission, where the satellite orbit maintains its initial orientation relative to the sun. Because of overflight restrictions, polar launches must be made from the West Coast location for safety purposes. Lower inclination equatorial launches are made from Kennedy Space Center off the coast of Florida, within the Eastern Range or from Wallops Island off the coast of Virginia (see Figure 2-3).

2.3 DESCRIPTION OF THE PROPOSED ACTION

The space launch vehicle planned to launch the STEP M1 is the Air Force Small Launch Vehicle (AFSLV), known commercially as the Pegasus XL. The AFSLV launch vehicle has been designed to benefit from equipment heritage and economies of scale. Developed by Orbital Sciences Corporation (OSC), the AFSLV meets more stringent U.S. Air Force (USAF) reliability requirements and has a greater payload-to-orbit capability than the standard Pegasus. The Pegasus XL is six feet longer than the standard Pegasus, and contains an additional 8,400 pounds of propellant (OSC, 1993b).

The STEP M1 launch will be the first flight of the AFSLV, and STEP M1 will be the only payload on this launch. The AFSLV will be carried aloft by an OSC-modified

Figure 2-1

Regional Location Map

Figure 2-2

STEP M1 Facilities on North VAFB

Figure 2-3

Orbit Inclinations Available from the Eastern and Western Ranges

Lockheed L-1011 passenger aircraft, which will take off from the existing airfield on North VAFB (Figure 2-2).

The flight path of the L-1011 aircraft heads initially northward from the airfield and VAFB for a distance of approximately 125 miles towards Monterey on the coast of California, where it will pass at an altitude of 39,000 feet. From Monterey, it will fly directly out over the Pacific Ocean for approximately 10 miles, and head north to the latitude of San Francisco. From that area, the L-1011 turns south and launches the AFSLV into a parking orbit of 80 degrees from the equator. The AFSLV will place STEP M1 at the parking orbit of approximately 165 x 750 kilometers (km). The spacecraft will use its four, one-pound thrusters to boost to its final orbit of 175 x 1,500 km.

The high inclination is needed to allow coordination between spacecraft receivers and various ground transmitters. The on-board propulsion system will provide orbit maintenance, since the low perigee (point in the satellite's orbit that is nearest the earth) will result in significant drag and continually lower the orbit energy.

The STEP M1 spacecraft is built primarily of aluminum, except for a single titanium fuel tank, approximately 30 inches in diameter. The modules and different configurations of the STEP M1 spacecraft are shown on Figure 2-4. The fuel is monopropellant-grade hydrazine (MIL-P-26536D, 170 pound maximum quantity), and the pressurant is gaseous helium (pressurized at 350 pounds per square inch gage, MIL-P-27407A). The fuel and pressurant will be loaded onsite at VAFB.

Launch of the STEP M1 spacecraft represents a continuation of the existing U.S. Air Force space program in support of scientific study. STEP M1 consists of one satellite to be launched, with a payload of four DOD experiments (see discussion below, Section 2.4). Each experiment is designed to research a different facet of the atmosphere. Three experiments are sponsored by various DOD agencies, however, the data collected by each experiment will complement the others.

The proposed action involves the ground processing and launch of the STEP M1 spacecraft at VAFB, in-orbit operation, and orbital decay and reentry. The STEP M1 program includes the use of three facilities on North VAFB:

- Building (Bldg) 1555 (Vehicle Integration Facility) for mission processing,
- the Pegasus Hot Pad Loading Area, adjacent to Taxiway A of the existing airfield, and
- the existing airfield for takeoff and landing of the L-1011 aircraft.

These facilities are shown on Figure 2-5. Bldg 1555, located at the end of Talo Road, is being modified for processing of OSC commercial launch systems and payload integration. A new Pegasus Hot Pad Loading Area has recently been constructed adjacent to Taxiway A. The area will be used for mating of the Pegasus launch vehicle to the L-1011 aircraft.

Figure 2-4

Modules and Configurations of the STEP M1 Spacecraft

Figure 2-5

STEP M1 Vehicle Integration Facility (Building 1555) and Pegasus Hot Pad Loading Area on North VAFB

Bldg 1555 modifications, construction of the Pegasus Hot Pad Loading Area, and the upgraded Pegasus XL launch vehicle were previously evaluated in an environmental assessment (OSC, 1993b). The standard Pegasus launch vehicle has previously been evaluated for environmental impacts (USAF, 1989a). No new construction or modification of existing structures is included in this proposed action.

STEP M1 has a planned operational life of 6 to 12 months. At the end of its operational life, all on-board fuel will be consumed, the orbit will decay, and the satellite will re-enter the atmosphere.

2.3.1 Satellite Component Transport

Transport stages for the STEP M1 satellite are shown on Figure 2-6. The STEP M1 satellite is being manufactured by DSI in McLean, Virginia. Solar panels for the satellite are being manufactured by TRW in Redondo Beach, California. The panels will be transported by truck to the DSI facility in Virginia. After assembly, initial processing and testing of the complete satellite in Virginia, the satellite and support equipment will be transported by truck to the Goddard Space Flight Center in Greenbelt, Maryland for environmental testing. Environmental tests simulate the launch and flight environment, and will be used to confirm the ability of the satellite to withstand these conditions. Following environmental testing, the satellite and support equipment will be transported by truck to the Vehicle Integration Facility (Bldg 1555) on North VAFB for final satellite preparation and loading of propellant into the satellite. The satellite will be packaged, padded, and tied down during truck transfers to prevent damage (except in conditions of a major motor vehicle accident). Truck routing and timing will be planned to minimize the possibility of an accident.

Transportation of the launch vehicle and fueled satellite will be conducted in accordance with all applicable requirements, as regulated under WRR 127-1. The AFSLV will be placed on a dedicated USAF assembly integration trailer (AIT) and towed with escorts along Talo Road, 35th Street, 29th Street, Tangair Road, and the OMCF taxiway to the Pegasus Hot Pad Loading Area located adjacent to Taxiway A (see Figure 2-5). The AFSLV will be towed beneath the body of the Lockheed L-1011, where it will be mounted. This hot pad area will be used only for AFSLV to L-1011 mating operations. The air conditioning systems will be transported with the AFSLV from Bldg 1555 to the hot pad. The AFSLV will remain at the hot pad loading area until the Western Range clears the aircraft for takeoff. Orbital Sciences Corporation will complete the mechanical arming and last chance system inspections at the hot pad before clearing all ground support equipment from the area and starting the L-1011 engines on the day of launch. When clearance is obtained, the L-1011 with AFSLV attached will takeoff from the airfield, and launch will occur from this air platform.

Figure 2-6

Transport of STEP M1 Components

2.3.2 Processing Procedures

Pre-launch processing procedures include those conducted after delivery of the fully assembled satellite at VAFB up until initiation of countdown operations. The processing and pre-launch period for STEP M1 will last approximately 30 days. Pre-launch procedures at VAFB include:

- Off loading and unpacking the STEP M1 space vehicle at Bldg 1555,
- Prepare ground support equipment for use and assemble satellite to flight configuration,
- Charge satellite batteries,
- Perform integrated systems test,
- Perform Consolidated Space Test Center compatibility test,
- Complete hydrazine fueling and helium pressurization,
- Arm the satellite ordnance and propulsion subsystem,
- Install solar panels,
- Rotate satellite to a horizontal orientation,
- Mount satellite on AFSLV,
- Perform modified integrated systems test,
- Integrate the AFSLV payload fairing,
- Transport the spacecraft to the Hot Pad Loading Area,
- Mount the launch vehicle on the Lockheed L-1011 carrier aircraft,
- Perform final prelaunch checks.

Bay 2 of Bldg 1555 will be dedicated to the STEP M1 throughout the processing period (Figure 2-7). Portable cleanroom tents will be erected as needed within Bay 2. No other payloads will be at the building during that period. Bldg 1555 has an existing approved explosive siting for 600 pounds of Class/Div. 1.1 explosives, or more than 150,000 pounds of Class/Div. 1.3 explosives. Hydrazine is not considered an explosive, and the proposed action does not have any explosive safety requirements. Explosive safety requirements of the Pegasus XL boosters were previously evaluated (OSC, 1993b). No modification to the explosive safety rating of Bldg 1555 is required for implementation of the proposed action. Bldg 1555 has facility lighting and grounding protection in accordance with Air Force Regulation (AFR) 127-100. Other safety requirements incorporated into the facility include continuous humidity/temperature control and monitoring, perimeter and access control, and a facility warning system.

Figure 2-7

Bldg 1555 General Layout

Hydrazine propellant fueling will be completed in the Hazardous Propellant Loading Area, located adjacent to Bay 2. One full drum of hydrazine (approximately 440 pounds) will be delivered to the loading area. Hydrazine propellant will be transferred to the satellite in a closed system with an attached hydrazine scrubber unit. Using a closed transfer system limits the possibility of vapors escaping into the air. Any remaining hydrazine will be re-sealed in the drum, and returned to the storage area. All transportation of hydrazine, empty fuel drums, and hydrazine contaminated transfer equipment is performed by the base hazardous waste contractor, Jacobs Services Company. The hydrazine fueling and disposal procedures are further discussed in Section 3.3, Waste Management.

Before mounting the AFSLV on the L-1011, a full rehearsal will be performed. The rehearsal is required to exercise the launch coordination logistics between ground operations, the carrier aircraft and chase aircraft. The ground operations and carrier aircraft will be based out of VAFB, while the chase aircraft will originate from Edwards Air Force Base, California. The chase aircraft (an F-16) will be used for flight safety with visual observations of the launch separation of the AFSLV from the L-1011. The rehearsal will occur within about one week of the scheduled launch.

2.3.3 Personnel Requirements

The STEP M1 program is not expected to require more than a total of 20 temporary operational personnel, who will be present at VAFB only during the launch processing and launch phase.

Launch operations consist of all activities necessary to prepare the satellite and space vehicle for launch. Launch operation personnel will include temporary vehicle drivers for the one vehicle transporting the pre-assembled satellite and components to VAFB. No new permanent personnel will be required at VAFB. A maximum of 20 contractor launch operations personnel from OSC, DSI, TRW, and other companies will work in one 8-hour shift or two 12-hour shifts (maximum) per day at VAFB. This number includes crane operators, a payload specialist, and range and safety personnel. All STEP M1 operations personnel involved in the integration and launch activities will be permanent OSC, TRW or DSI personnel. Additional persons, including government and contractor personnel, may also be present.

2.4 MISSION

The overall goal of the STEP program is to support DOD in obtaining vitally needed scientific data about space and the earth's environment by creating low-cost, lightweight, standardized satellites for science payloads. The STEP M1's goal is to fly the four mission experiments, and accomplish their goals of data collection. STP is procuring a Class C equivalent space vehicle based on an adaptable spacecraft bus to support numerous STP experiments. Class C space vehicles are those which are medium or higher risk efforts

that are economically reflyable or repeatable. The characteristics for Class C space vehicles usually involve some combination of the following features: medium to high national prestige, short life, low to medium complexity, small size, single string design (i.e., no backup systems for individual components), hard failure modes (i.e., component failure results in system shutdown), very limited flight spares, medium cost, short schedule, and noncritical launch time. Vehicle and experiment retrievability or in-orbit maintenance is usually possible, such as typified by Spacelab or Orbiter attached payloads (USDOC, 1986).

The payload for Mission 1 of STEP consists of four DOD experiments, each designed to research different facets of the atmosphere. Once analyzed, this data will promote technological advances in high frequency communications, atmospheric modeling for aircraft and spacecraft, and provide possible insight into the prediction of geophysical phenomena such as earthquakes. Existing USAF remote tracking stations around the world will be used to gather data from the satellite.

Figure 2-8 shows the layers of the atmosphere, the relative position of each layer to the earth, and the extent of each layer. Elevations of the layers vary according to different literature. The layers of the earth's atmosphere are described below:

- The troposphere begins at the earth's surface and extends to an altitude of approximately 5 miles or 8 km at the poles, and 9 miles or 15 km at the equator (Byers, 1974; Koeppe and DeLong, 1958). The altitude varies with season. The troposphere comprises the lower atmosphere. In general, temperature decreases with increasing altitude in this layer. Rapid decreases in temperature with increasing altitude are unstable, hence the troposphere is a very dynamic region of the atmosphere.
- The stratosphere begins at the tropopause, which is the top of the troposphere. The stratosphere extends to an altitude of approximately 30 miles (50 km). It is part of the middle atmosphere and is characterized by a temperature structure in which temperatures generally increase with increasing altitude.
- The mesosphere begins at the stratopause, which is the top of the stratosphere. The mesosphere extends to an altitude of approximately 50 miles (80 km). It, along with the stratosphere, comprise the middle atmosphere. However, the temperature structure of the mesosphere is generally one of decreasing temperature with increasing altitude.
- The thermosphere begins at the mesopause, which is the top of the mesosphere. The thermosphere is part of the upper atmosphere. The top of the thermosphere is not well defined, but a generally accepted value is 600 miles (900 km). The temperature structure of the thermosphere is generally one of increasing temperature with increasing altitude.

Figure 2-8

Earth's Atmospheric Layers

- Within the thermosphere is the ionosphere. The ionosphere exists because of the ionization of atmospheric gases by solar radiation, hence its name. Because of the affects of ions on electromagnetic wave propagation, this layer is important to long range communications and radar systems. Also present in the ionosphere is plasma, a collection of charged particles containing the same number of positive ions and electrons. Plasma is electrically conductive, and is strongly affected by the earth's magnetic field.

The experiments aboard the STEP M1 are described below. Although the experiments are sponsored by various DOD agencies, the data collected by each experiment will complement the others. This interactive effect was not coincidental; many of the STEP M1 experiments, or principal investigations, have worked together on previous spacecraft.

2.4.1 Ducted Wave Propagation Experiment

The purpose of the Ducted Wave Propagation (DUCTED) experiment is to investigate the feasibility of exploiting ultra-long range, low-loss ionospheric ducted wave propagation for communications and surveillance systems. The experiment will also perform bottomside tomography experiments. Tomography is a diagnostic technique using x-ray photographs in which the shadows of structures before and behind the section under scrutiny do not show. Bottomside tomography is a passive technique that passes a receiver through the bottomside location of a band of electrons in the ionosphere to indirectly measure electron content. The DUCTED experiment, sponsored by Rome Laboratory (USAF), will provide the total electron content of sections of the ionosphere, and will help model the radio frequency propagating properties of the changing atmosphere.

2.4.2 Atmospheric Density Specification (ADS) Experiment

The ADS experiment group consists of three smaller experiments, each of which measures complimentary qualities of the earth's upper atmosphere. The ADS experiment is designed to obtain coordinated measurements of aerodynamic drag and density. This includes studying neutral and ionospheric composition, winds and temperature, developing new, more accurate operational satellite drag models by measuring atmospheric dynamic processes and relating them to high latitude energy inputs. When complete, the data collected will improve the existing atmospheric models to meet the needs of ongoing and planned classified and unclassified studies which include the National Aerospace Plane. The ADS experiment group consist of the ADMS, CADS and SETA experiments, described below. The ADS experiment is sponsored by Phillips Laboratory (USAF).

- **Atmospheric Density Mass Spectrometer (ADMS)**

The ADMS is of a state-of-the-art mass spectrometer, specifically designed to measure atmospheric density to within five percent. Existing models provide density with 20 percent error.

- **Composition And Density Sensor (CADS)**

CADS also consists of a complex, modern mass spectrometer. Unlike ADMS, CADS is designed to measure relative atomic and molecular composition, as well as along-track winds in the upper atmosphere. CADS incorporates flight-proven concepts to take temperature measurements by analyzing the retarding potential of ion energy.

- **Satellite Electrostatic Triaxial Accelerometer (SETA)**

SETA uses a miniature electrostatic satellite accelerometer device to measure satellite drag and cross-track winds experienced by the spacecraft. The extreme sensitivity of SETA will aid in the on-orbit calibration of the other ADS group experiments.

The SETA sensor located in the core module of the satellite contains 1.6 microcuries (μCi) of Radium 226 in solid form, which serves as a static eliminator. The chip, which is 1/16 inch by 1/16 inch, contains 1.6 μCi of Radium 226 as radium sulfate impregnated gold foil. This chip is securely mounted and sealed inside the SETA box. The radioactive chip serves as a static eliminator by ionization of the atmosphere within the acceleration sensor.

2.4.3 Coordination of Heating And Modification Processes into the IONosphere (CHAMPION) Experiment

The CHAMPION experiment will investigate the effects of large amplitude, nonlinear plasma interactions in the ionosphere. Using Langmuir and electric field probes, the experiment will measure electron density, temperature, electronic field strength, and plasma properties over a wide range of altitudes. Langmuir probes are passive receivers used to measure current flow and charge of plasma. As the title suggests, ground transmitters will heat or modify the ionosphere in the path of the spacecraft. The effects on the ionospheric properties will be measured and a quantifiable model created. In addition, plasma instabilities in the auroral and equatorial regions will be measured as well. The CHAMPION experiment is sponsored by the Naval Research Laboratory.

2.4.4 Plasma Environment Analyzer (PEA) Experiment

The PEA experiment will collect data leading to a comprehensive information profile on the ionospheric state, its condition of irregularity, its susceptibility to exploitation as a plasma laboratory in space, its disposition to modification and control, and its signal channel characteristics over the extremely low frequency - extremely high frequency domain. PEA shares data with the CHAMPION receiver and also uses interaction with fixed ground transmitters to perform its measurements. The PEA consists of a 100 Hertz - 100 kiloHertz frequency receiver, two electric field preamplifiers, two electric field

antennae, one magnetic field preamplifier, and one magnetic field antenna. The PEA experiment is sponsored by the Aerospace Corporation.

2.5 ALTERNATIVES TO THE PROPOSED ACTION

The STEP Program was designed to meet a specific DOD mission requirement: provide inexpensive access to space using an adaptable spacecraft bus to support numerous STP experiments. It is a mission requirement to fly four DOD experiments in an 80^{o} inclination (from the equator) near-polar orbit at specified altitudes to collect data on ionospheric propagation phenomena and obtain measurements of upper atmospheric composition and dynamic processes.

2.5.1 No Action Alternative

Discussion of the no action alternative is required by the National Environmental Policy Act. If the STEP M1 program is not implemented as planned, DOD would not be able to fulfill the mission requirement. Under the no action alternative, it would not be possible to obtain the scientific and experimental data required for mission accomplishment. Specifically, there is no other alternative to this proposed method of collecting the atmospheric and ionospheric data promised to the DOD by the laboratories. Each of the experiments would obtain unique data that can only be collected in space, in a low-earth orbit, and at the specific altitudes and atmospheric conditions required for each experiment. This data is not currently being obtained on earth or in space from other experiments. There are no other space experiments planned to gather this data in the areas needed to support DOD atmospheric and ionospheric models. These models will serve a unique purpose by supporting SPACECOM, the Air Weather Service, and other users of the data.

If the STEP M1 program is not implemented, DOD would also not be able to establish a precedent for future launch opportunities for satellite spacecraft users. This could result in the inability to launch this size category of satellites into polar orbit and, as such, may further result in the inability to advance current scientific knowledge.

2.5.2 Other Alternatives

There are no other available launch vehicles or combinations of systems in the U.S. inventory that can fulfill mission requirements of the STEP M1. Use of the limited payload opportunities on existing Titan, Atlas and Delta launch vehicles would place additional requirements on schedules, planning, and availability, and may result in the inability to carry out the STEP M1 mission as planned. Use of these launches would place small payloads in suboptimum orbits with larger payloads, adding unacceptable risk to satellite performance. Other vehicle or program concepts submitted as AFSLV are not alternatives because they have not been developed and are not available.

Use of remote sensors or high-flying devices (i.e., telescopes or balloons) would not accomplish all of the objectives of the mission. It is not possible to gather the required data without the use of a satellite.

A variety of launch sites were initially considered. Previous Pegasus missions have been flown from the National Aeronautics and Space Administration (NASA) Dryden Flight Test Facility at Edwards Air Force Base. Each of these missions have used, and will use, a NASA B-52 aircraft as the launch platform. There are two Pegasus missions remaining. Use of the Dryden Flight Test Facility is not possible for STEP M1 because NASA has decided to no longer support other commercial endeavors after the last Pegasus mission is flown. The Dryden facility will no longer support OSC activities after 1994.

Use of a B-52 aircraft for the STEP M1 launch is not possible because the longer and heavier Pegasus XL was not designed or manufactured to be carried by the B-52. OSC has made the decision to depart from use of the NASA aircraft in favor of a completely commercial L-1011 carrier aircraft.

Although the AFSLV may be launched from Wallops Island or the Eastern Range at some later date, the specific mission of the STEP M1 requires an inclination for the orbit that is higher (80º from the equator) than would be possible from the Eastern Range (39º to 57º) or from Wallops Island off the coast of Virginia. Therefore, these sites are not being considered as alternatives to STEP M1 launch at this time. For these reasons, the only site considered is VAFB. This site has been approved for this program by the Air Force.

The Air Force has considered each of the above alternatives to the proposed action. It was determined that these alternatives would not meet mission requirements. Therefore, these other alternatives were eliminated from further consideration and will not be evaluated in this EA. The Air Force has selected the proposed action as the preferred alternative.

2.6 MITIGATION MEASURES

The proposed action will not result in significant adverse impacts on the affected environmental resource areas analyzed. Potential adverse impacts are either not anticipated, or may occur at less-than-significant levels. No mitigation measures are required for the proposed action.

SECTION 3

AFFECTED ENVIRONMENT

SECTION 3

AFFECTED ENVIRONMENT

This section of the Environmental Assessment (EA) describes the existing environmental conditions that would be affected by the proposed action. The study area for each environmental resource is limited to the immediate area of Bldg 1555 on North Vandenberg Air Force Base (VAFB), the airfield, and the atmosphere in which the satellite is placed. For some environmental resources, a regional study area was used, as appropriate.

The affected environment pertinent to the major issues of air quality, effects on global climate change, space debris, safety, and waste management have been subject to comprehensive discussion in this section. The minor issues evaluated in this section are noise, public services, utilities and transportation, socioeconomics (population, housing and employment), hydrology and water quality, natural resources, energy, and visual resources. Because the proposed action does not include the construction of any new ground facilities, the topics of biological resources, cultural resources, coastal resources, and soils and geology have not been evaluated. These subjects were evaluated as appropriate in previous environmental documentation for new or modified facilities to be used for this program. Some of the discussions in this EA supplement and update information presented in the previous environmental documents.

3.1 AIR QUALITY

3.1.1 Climate

The climate of the South Central Coast Air Basin can be categorized as a Mediterranean type. The weather is warm and dry from May to October, and wet and cool from November to April (CARB, 1975). Mean daily temperatures range from the low fifties in January to the low sixties in September. The average annual temperatures are around 55°F. Much of the rainfall occurs during the winter months with February being the wettest month (about 2.9 inches). Small amounts of rainfall may occur during the summer months. The average rainfall in the area is approximately 14 inches.

Historical data collected near the project site reveals an annual predominant and secondary predominant wind pattern in the area. Predominant winds from the northwest sector account for almost 44 percent of the recorded wind directions, while the secondary predominant winds from the east-southeast sector account for nearly 15.3 percent of the recorded wind direction. The annual average winds from the northwest sector and east-southeast sector are 9.5 miles per hour and 6.2 miles per hour, respectively. The annual average wind speed is 6.8 miles per hour (CARB, 1984).

3.1.2 Local Air Quality

Five air quality monitoring stations located near or within VAFB are used to describe the existing air quality in the area. These monitoring stations are: VAFB - Watt Road; VAFB- Point Arguello; VAFB - Space Transportation System (STS) Power Plant on Power Street; Jalama Beach; and, Lompoc - 128 South H Street (see Figure 3-1). The VAFB Watt Road monitoring station, located on North VAFB, is the nearest to the project site. The criteria air pollutants measured at the monitoring stations include ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and particulate matter less than or equal to ten microns in aerodynamic diameter (PM_{10}) (SBCAPCD, 1991).

Data collected at the monitoring stations reveals that the SO_2, NO_2 and CO ambient concentration levels do not exceed state and federal air quality standards. However, violations of the PM_{10} or O_3 air standards were recorded at four of the monitoring stations. The Jalama Beach monitoring station recorded two violations of the PM_{10} 24-hour state standard. The VAFB - STS Power Street monitoring station, VAFB - Point Arguello monitoring station, VAFB Watt Road monitoring station and Lompoc - 128 South H Street monitoring station recorded seven days, two days, and one day, respectively, which exceeded the O_3 1-hour state standard. The Vandenberg - STS Power Street monitoring station recorded one day that exceeded the O_3 1-hour federal air standard. A summary of the air quality data recorded at the five stations and air standards is shown on Table 3-1.

3.2 GLOBAL CLIMATE CHANGE AND STRATOSPHERIC OZONE DEPLETION

The possibility of global climate change and stratospheric ozone depletion due to the increased introduction of certain gases into the atmosphere through human activity is a widely publicized, global issue with potential major long-term implications to global climate and ecosystems. Over the last 100 years the temperatures in the northern and southern hemispheres have increased by about 0.5^{o}C (AMS, 1991). A recent comparison of the hemispheric temperature histories performed by Idso (1990) found striking trends associated with the increased industrialization that occurred after 1950. Beginning in the mid-1950s, northern hemisphere temperatures stopped rising at the rate that characterized the twentieth century, while those in the southern hemisphere continue to rise, though at a slightly lower rate than characterized the first half of this century. Recent studies by Karl et al. (1993) have also shown a rise of the global land mass minimum temperatures at a rate three times that of the maximum temperature during the period of 1951 through 1990. The decrease in the daytime temperature range is at least partially related to increases in cloud cover over the land masses. The climate change and stratospheric ozone-depletion issues are related by common gases contributing to both problems and interrelated

processes affecting the transport, transformation and ultimate by-products of the reactions of the gases with sunlight.

Figure 3-1

Air Monitoring Stations in the VAFB Area

Table 3-1
Summary of Air Quality Data at VAFB and Vicinity

Pollutant	VAFB Watt Road[a]	VAFB Point Arguello[b]	VAFB STS Power Plant[b]	Jalama Beach[b]	Lompoc 128 South H St.[b]	NAAQS[c]	CAAQS[d]
Ozone (O_3)							
1-hour average, ppm	0.10	0.11	0.13	0.07	0.11	0.12	0.09
Carbon monoxide (CO)							
1-hour average, ppm	1.2	ND	2.10	ND	4.00	35	20
8-hour average, ppm	1.0	ND	1.14	ND	2.00	9	9
Nitrogen dioxide (NO_2)							
1-hour average, ppm	0.02	0.04	0.03	0.02	0.06	--	0.25
Annual average, ppm	ND	0.002[e]	0.001	0.002[e]	0.012[e]	0.053	--
Sulfur dioxide (SO_2)							
1-hour average, ppm	0.01	ND	0.01	0.01	0.02	--	0.25
3-hour average, ppm	0.01	ND	ND	ND	ND	0.5	--
24-hour average, ppm	0.002	ND	0.05	0.00	0.00	0.14	0.04
Annual average, ppm	ND	ND	0.000	0.000[e]	0.000	0.03	--
Suspended particulates (PM_{10})							
24-hour average, ug/m^3	36.6	ND	37.70 [f]	93.70 [f]	ND	150	50
Annual average, ug/m^3	ND	ND	ND	ND	ND	50	30

Source: [a] SBCAPCD, 1993 (Period of record: May 1992 to March 1993)
[b] CARB, 1991 (Period of record; calendar year 1991)
[c] NAAQS = National Ambient Air Quality Standards
[d] CAAQS = California Ambient Air Quality Standards
[e] Insufficient data for representativeness to EPA and CARB criteria
[f] SBCAPCD, 1991

ND - No Data

- **Global Climate Change**

Global climate change refers to the Earth's heat balance being disrupted by the abundance of certain gases and aerosols in the atmosphere that absorb infrared radiation. The layer of gases in the atmosphere functions much the same as glass in a greenhouse; both prevent the escape of heat. Water, in its various forms, is by far the most important greenhouse gas. Other naturally occurring or man-made gases that contribute to global warming include carbon dioxide (CO_2), chlorofluorocarbons (CFCs), methane (CH_4), and nitrous oxide (N_2O).

The absorption of solar radiation and the absorption and emission of infrared radiation in the atmosphere dominates the earth's energy balance. Approximately 30 percent of the incoming solar energy is reflected by either clouds and particles in the atmosphere, or

from the earth's surface. The balance of the energy is absorbed, used in various chemical processes and emitted as infrared energy by both the atmosphere and the earth's surface. Clouds and greenhouse gases in the atmosphere then absorb the energy and return the heat to the earth. Greenhouse gases accumulate in the stratosphere and contribute to global warming by reducing the amount of solar energy (in the form of ultraviolet [UV] radiation) that would be initially reflected back into space. This results in an increase in the amount of infrared (IR) radiation which can then be absorbed in the troposphere (Matthews, 1990; SCAQMD, 1989; Margulis and Lovelock, 1974). It is widely accepted that continued increases in greenhouse gases will cause global warming, although there is uncertainty concerning the magnitude and timing of the warming trend (SCAQMD, 1992).

Suggested ecological effects of increased global warming include: higher ocean temperatures, which will severely affect climate and the abundance of phytoplankton (microscopic plantlife floating or weakly swimming in water bodies); polar ice-cap melting, which will release significant quantities of CO_2 and CH_4 trapped in the ice and which may further contribute to global warming; a potential rise in sea level, which could result in the destruction of coastal wetland habitat; an increase in temperature, which could result in a decrease in accessible freshwater drinking supplies; and an increased rate of mortality in plant and animal species (particularly those of limited distribution, movement and reproductive capabilities) due to related climatic change. The severity of expected impacts will vary with latitude (SCAQMD, 1989; Matthews, 1990; Peters and Darling, 1985).

As indicated above, water (H_2O) vapor is by far the most abundant absorber and emitter of infrared energy in the atmosphere. The various forms of H_20 transport most of the heat energy from one level to another within the atmosphere. Atmospheric water vapor also reflects or emits most of the energy back to space. Increased atmospheric water vapor may both alleviate and contribute to global warming. It alleviates warming because additional cloud cover would increase the earth's albedo, or reflectivity. This means that more of the solar (UV) radiation would be reflected back to space. The abundance of this resource on earth, as well as the results from experiments on the effects of cloud cover on temperature, leads some to the conclusion that the cooling effect will dominate the warming effect. This increased cloud cover also contributes to global warming by more efficiently absorbing the IR radiation which passes through the atmosphere and is radiated by the earth. Currently under debate is the question of whether the global temperature feedback from H_20 is positive (overall temperature increase) or negative (overall temperature decrease) (Sun and Lindzen, 1991; Lindzen, 1990; Ellsaeasser, 1990; Idso, 1989). In all large numerical models of global warming, a warming of the surface of the earth causes an increase in water vapor at all levels in the atmosphere (Manabe and Wetherald, 1980). This increase in atmospheric moisture in the

models magnifies the heating effect of the minor greenhouse gases, such as CO_2, by a factor of about 3.

The less abundant greenhouse gases (CO_2, CH_4, CFCs, N_2O and tropospheric O_3) are estimated to be present in higher concentrations now than at any other time over the past 160,000 years. This is largely due to the direct and indirect influence of human activity. The levels of these gases are still rising (Matthews, 1990; Kennett, 1982).

As calculated by general circulation models, CO_2 is the second most abundant heat-absorbing gas and accounts for about 55 percent of the contribution to the warming effect (SCAQMD, 1992). The relationship between CO_2 concentrations, biological organisms and global temperature change is dynamic and interdependent. As a result, it is not clearly understood and, therefore, difficult to model. Fossil fuel use and forest clear-cutting increase the amount of CO_2 in the atmosphere because they overwhelm the biological respiration processes that remove CO_2 from the atmosphere. Atmospheric CO_2 decreases through conversion by photosynthetic plants and phytoplankton to carbohydrates. Forest clear-cutting, particularly in tropical rain forests, significantly affects the global efficiency of photosynthetic plants, by reducing the number of plants available to remove CO_2 from the atmosphere. CO_2 is also removed from the atmosphere through dissolution into the ocean, where it is converted to calcium carbonate ($CaCO_3$) by living organisms such as bivalves and corals. It has not been determined what the buffer capacity of the world's oceans is for CO_2, and the subsequent effect that this dissolution will have upon ocean water pH, water temperature, and global currents. CO_2 can persist in the atmosphere up to 100 years (Matthews, 1990; SCAQMD, 1989; Harte, 1988).

CFCs absorb 16,000 times more heat than atmospheric CO_2 per unit mass and account for approximately 24 percent of the calculated human-induced effects on global warming. CFCs have been used since the 1930s as refrigerants and coolants. CFCs are broken down in the atmosphere by UV radiation, thereby releasing elemental chlorine (Cl_2) or the chlorine radical (Cl^-). The net result of these reactions is the depletion of stratospheric O_3. The Cl_2 and Cl^- released from the CFCs can catalyze over 100,000 of these reactions, which, in turn, result in greater potential stratospheric O_3 depletion. The consequential result is an increase in the amount of UV radiation that penetrates the atmosphere, which has the potential to increase the incidence of skin cancer. In addition, this UV radiation could ultimately contribute to surface warming because it will be absorbed in the troposphere and at the surface instead of in the stratosphere. Some CFCs can persist in the atmosphere for nearly 400 years (Matthews, 1990; SCAQMD, 1989; Bowman, 1988).

CH_4 absorbs over 20 times more heat than CO_2 per unit mass and accounts for 15 percent (SCAQMD, 1992) of the contribution to global warming. Atmospheric CH_4 increases as a result of various biological processes associated with digestion in cattle,

flooded areas, landfills and other areas where life exists in the absence of oxygen. CH_4 persists in the atmosphere for about ten years (Matthews, 1990; SCAQMD, 1989; Margulis and Lovelock, 1974). N_2O absorbs 200 times more heat than CO_2 per unit mass and accounts for approximately six percent of the calculated effects on global warming. Atmospheric N_2O increases as a result of continued use of fossil fuels and "slash and burn" forestry techniques. N_2O persists in the atmosphere up to 180 years (Matthews, 1990; SCAQMD, 1989).

Tropospheric O_3, a caustic and common component of surface air pollution, is increasing in concentration. This is due largely to industrial and automotive pollutants, and the greater amount of UV radiation which is reaching the earth's surface. Ultraviolet radiation participates in reactions to both form and destroy ozone, with heat produced in both instances. At higher altitudes, the O_3 formation cycle would have the benefit of preventing UV penetration of the atmosphere. However, at lower altitudes, significantly higher levels of UV radiation and associated reactions could further contribute to surface warming.

Output from global climate models show that, over the next 50 years, greenhouse gas accumulations may result in surface temperature increases between 0.1 and 3° Celsius, depending on parameterizations in the models. The initiation of aggressive limits on greenhouse gas releases, or a continuation of current trends, may lead to smaller or larger changes, respectively, than those forecast by the models.

In addition to the emissions of greenhouse gases, man-made smoke and sulfate aerosol emissions have occurred during roughly the same period (Duffy, 1993). These aerosols cool the climate directly by reflecting solar radiation and indirectly by forming cloud condensation nuclei. The nuclei are the small particles needed for the formation of clouds. Increasing the amount of nuclei will increase the formation of clouds, thereby increasing the earth's reflectivity. Thus, any significant warming that may have been introduced by the greenhouse gases may have been offset by the aerosol cooling effect.

Each of the factors described above may have varying contributions to global climate change depending on the altitude, latitude and interdependence on each other. Hansen and Lacis (1990) have also argued that because of the long atmospheric residence time of CO_2, a substantial warming pulse has been hidden by the cooling effects of sulfates and that pulse will emerge soon after SO_2 emissions are reduced. Idso (1991) suggests that as the CO_2 content of the atmosphere rises, so will the impetus for forest expansion to assimilate the CO_2, as long as the various processes that produce CO_2 do not produce an abundance of detrimental pollutant byproducts. It is clear there is still much to be understood about the interactions of all of those contributing factors in the atmosphere and the eventual impact on global climate change.

The launch of the Space Test Experiments Platform Mission 1 (STEP M1) satellite has the potential to contribute to global climate change effects as a result of emissions from the ground support operations, emissions from the transport vehicle bringing the launch system to altitude, the rocket exhaust emissions into the atmosphere following release from the transport vehicle, and emissions from the satellite booster motors.

- **Stratospheric Ozone Depletion**

Various compounds, including CFCs, halons, carbon tetrachloride, methyl chloroform, fluorine, chlorine, bromine, iodine or astatine containing compounds have been accumulating in the troposphere, and are transported into the stratosphere through vertical atmospheric motion. Within the troposphere, the compounds are relatively inert, and the primary concerns are for concentrations that would be considered toxic. In the stratosphere, these compounds participate in complex chemical reactions to destroy ozone, a compound that absorbs most of the UV radiation from the sun. Destruction of the ozone layer thus increases the penetration of UV radiation to the earth's surface, a known risk factor that would increase the incidence of skin cancers, cataracts and immune deficiencies. The increased UV radiation may potentially contribute to crop and fish damage and further degrade air quality by increasing the UV radiation available in the troposphere for photochemically generated pollutants.

Ozone in the stratosphere is formed by the photolysis of molecular oxygen (O_2). The chlorine chemistry that destroys the O_3 uses reactive chlorine, freed by photochemical reaction with UV radiation, from CFCs or other compounds as a catalyst for the disassociation of an oxygen atom from O_3. The chlorine atom is then released by further reactions and free to catalyze additional O_3 destruction. A single chlorine atom may destroy as many as 100,000 ozone molecules before it is inactivated or eventually returned to the troposphere, where precipitation or other processes removes it from the atmosphere (Stolarski, 1988).

Recent research (Newman et al., 1993) has shown a primary mechanism for causing large changes in the Arctic stratospheric chemistry has been mixed processes within polar stratospheric clouds (PSCs). The PSCs consist of various nitric acid hydrates, sulfuric acid aerosols, and water ice particles. During early and mid-winter when temperatures drop to below 195° Kelvin, the conditions are established for ozone removal as sunlight returns at the end of winter. In the northern hemisphere vortex (the Arctic region where ozone depletion occurs), the period of significant loss is relatively short because of the warmer, less stable Arctic vortex dissipating by late winter. When the PSCs are formed, the chemical reactions that take place dramatically shift the balance between inactive and active forms of chlorine and increase the efficiency of chlorine in catalytic ozone removal.

Observing the seasonal onset of the chemical ozone loss is not as easily performed in the northern hemisphere as it is in the southern hemisphere because it is masked by increases that are a result of air transport (Proffitt et al., 1993). Furthermore, loss of stratospheric ozone in the mid-latitudes is not completely understood, but it appears that the decreases are due to chemistry occurring at mid-latitudes and transport of ozone-poor air from the polar areas to the mid-latitudes.

In 1990, the National Aeronautics and Space Administration (NASA) provided a report to Congress (NASA, 1990) updating the present state of knowledge of the upper atmosphere. The relevant major findings of the report are summarized below:

- The weight of scientific evidence strongly indicates that chlorinated (largely man-made) and brominated chemicals are primarily responsible for the observed substantial decreases of stratospheric ozone over Antarctica in the springtime.
- While the magnitude of the ozone loss over the Arctic is comparably less than that over the Antarctic, the same potentially ozone-destroying processes have been identified in the Arctic stratosphere. The degree of any future ozone-depletion will likely depend on the particular meteorology of each Arctic winter and future atmospheric levels of chlorine and bromine.
- The analysis of the total-column ozone data from ground-based Dobson instruments shows measurable downward trends from 1969 to 1988 of three to five percent (i.e., 1.8 to 2.7 percent per decade) in the Northern Hemisphere (30 to 64°N latitudes) in the winter months that cannot be attributed to known natural processes.

In early 1992, NASA identified a large concentration of ozone-depleting chemicals in the stratosphere (Parkin and Soong, 1992). The finding led to the prediction that, for the first time, a large region of depleted ozone would develop over a populated area by the end of 1992. That predicted region, over Canada and the northeastern U.S., prompted the U.S. government to accelerate the schedule of phase-out of ozone-depleting substances. Preliminary evaluation of the data collected has shown that the anticipated ozone hole did not appear (Gant, 1993). However, the loss of ozone may have been offset by transported ozone from other latitudes.

The STEP M1 launch vehicle has the potential to contribute to the ozone depletion problem as a result of chlorine emissions from rocket exhaust into the atmosphere and ground support operations that potentially would release ozone-depleting compounds.

3.3 WASTE MANAGEMENT

Waste management is the responsibility of each individual and organization at VAFB. Nonhazardous solid waste is disposed at the Base landfill (see discussion under Section 3.5.2, Solid Waste). Hazardous waste management at VAFB is regulated under the Code of Federal Regulations (CFR), Title 40, Parts 260 through 270, and the California Code of Regulation (CCR) Title 22. All projects must comply with the base Hazardous Waste Management Plan (85-50-5/89) and Spill Response Plan (234-89), both currently being revised.

3.3.1 Toxic and Hazardous Waste

Hazardous wastes not recycled or reused are placed in interim storage for up to 90 days at the designated Collection Accumulation Points (CAP) on-base, managed by Jacobs Services Company. Jacobs Services Company completes paperwork for tracking before transporting the wastes to the permitted Treatment, Storage and Disposal Facility on VAFB (Bldg 3300). From this location, an Environmental Protection Agency (EPA)-permitted hauler (Security Environmental Services, EPA # CAD980887475) collects it for off-site disposal. The Defense Reutilization and Marketing Office, a government agency that operates the permitted storage facility at the base, contacts the hauler whenever hazardous waste must be removed off-base.

Flammable materials storage lockers are located inside Bldg 1555. Isopropyl alcohol, utilized during satellite processing, will be stored in these lockers. A large walk-in bunker, located outside Bldg 1555, will be used for storage of ordnance.

Toxic and hazardous materials that are part of the satellite, or will be utilized during satellite processing, have been identified in previous documents (OSC, 1993b; DSI, 1993). These materials are briefly listed below.

NiCd Batteries. Three 28 volt 80 amp-hour nickel cadmium (NiCd) battery packs are contained on the satellite. Each battery pack is protected from catastrophic shorting by a 30 amp fuse.

Ammonia. The heat pipe within the satellite contains 48.6 cubic inches of ammonia gas pressurized at 124 pounds per square inch atmospheric (psia) at 20° Celsius (nominal), or 600 psia at 80° Celsius (maximum operating).

Radium 226. The SETA experiment instrument box contains 1.6 microcurie of Radium 226 in solid chip form. The chip is protected from significant human exposure by metal containment.

Gaseous Nitrogen. The satellite propulsion system contains gaseous nitrogen between 10 and 50 pounds per square inch gage (psig) before fueling operations (the psig measurement is commonly used with compressed gas bottles; one psig + 14.7 = one psia). The bulk of this gas is contained in the 22 inch diameter spherical propulsion fuel

tank. The gaseous nitrogen will be stored in nonliquified compressed gas bottles at approximately 2,000 psig for use during processing operations.

Gaseous Helium. After post fueling pressurization, the propulsion system contains approximately 1,000 cubic inches of gaseous helium at 350 psig. Gaseous helium will be stored in nonliquified compressed gas bottles at approximately 2,000 psig for use during processing operations.

Hydrazine. The propulsion subsystem is a propellant hydrazine system which provides the satellite with orbit and altitude control. After fueling, the satellite will contain a maximum of 170 pounds of propellant hydrazine at 350 psia.

Hydrazine fuel is not stored at Bldg 1555. Hydrazine is stored at designated CAPs on VAFB. One 55-gallon drum of hydrazine (approximately 440 pounds) will be delivered to the facility by truck from the CAP on South VAFB. A maximum of 170 pounds of hydrazine will be loaded into the satellite. The actual amount of hydrazine loaded into the satellite may be less than 170 pounds, depending upon final weight adjustments. The remaining hydrazine material will be resealed in the drum and returned to the fuel storage area. All transportation of hydrazine, including empty fuel drums, is performed by the base hazardous waste contractor, Jacobs Services Company.

The fuel will be transferred to the satellite via a fueling cart owned by the Air Force, and currently in use for an existing program at Bldg 1559. TRW personnel will perform the hydrazine fueling for the STEP M1. The fuel loading cart controls hydrazine flow into the satellite, measures mass transfer, regulates pneumatic pressure during pressurization, and provides and controls vent lines to a scrubber unit. Once transfer of the hydrazine is complete, all lines used in the transfer are sealed. Following completion of the fuel transfer operation, the lines of the transfer equipment which may contain residual hydrazine will be cleaned by TRW personnel. Rinsate waste and line flush waste will be sealed in a drum and disposed as hazardous waste. The amount of rinsate waste is not expected to exceed the volume of one 55-gallon drum. A record of the propellant transfer operation will be kept.

Isopropyl Alcohol. Isopropyl alcohol is used for cleaning covers and insulation. A maximum of one gallon would be used for satellite processing. Records of isopropyl alcohol use for the proposed action will be kept.

3.3.2 Pollution Prevention

Pollution prevention policies and procedures have been issued by the federal government through the Pollution Prevention Act of 1990, the National Environmental Policy Act (Pollution Prevention), the Department of Defense Directive 4210.15, and Council on Environmental Quality memoranda. These laws and regulations require agencies to investigate and act on pollution prevention and waste minimization opportunities at their facilities. The objectives of pollution prevention programs are to: (1)

prevent or reduce waste at the source; (2) recycle or reuse waste that cannot be prevented or reduced; (3) treat waste that cannot be prevented or recycled; and (4) dispose of waste only as a last resort.

The goal of Department of Defense Directive 4210.15, Hazardous Material Pollution Prevention (HMPP) is to eliminate or reduce the use of hazardous materials in processes and products, instead of relying on management of hazardous wastes. Where the use of hazardous materials cannot be avoided, personnel are to apply management practices that avoid harm to human health and the environment.

Pollution prevention is the responsibility of each individual user (i.e., tenant, contractor, etc.) and organization on VAFB who engages in any activity that uses, stores or disposes of any substance which could result in emissions of pollutants to the environment. Opportunities for pollution prevention are continually identified during the course of program planning. These opportunities are evaluated and implemented to minimize costs and prevent potential harm to the environment.

3.4 NOISE

Noise is most often defined as unwanted sound. People judge the relative magnitude of sound sensation in subjective terms such as "loudness" or "noisiness." Physically, sound pressure magnitude is measured and quantified on a scale which indicates the sound level in units of decibels (dB). All sound pressure levels discussed in this evaluation are calibrated to the standard reference pressure of 20 micropascals, per ANSI S1.8-1989 (ANSI, 1989).

The human hearing system is not equally sensitive to sound at all frequencies. Because of this variability, a frequency-dependent adjustment called A-weighting has been devised. This weighting allows sound to be measured in a manner similar to the way the human hearing system responds. The use of the A-weighted sound level is often indicated by using the abbreviation "dBA." An increase in sound level of 10 dBA is judged by most people to be approximately twice as loud, whereas most people are unable to detect a change in sound level of less than 3 dBA (for sources having a broad frequency spectrum such as traffic noise).

In a typical outdoor environment, the noise level varies over time according to various activities in the community (e.g., automobiles on a nearby street, aircraft overflight, dog barking, etc.). In order to report the instantaneous noise level, it is necessary to reference a specific point in time when that noise level occurred. Instantaneous noise levels are not practical, since they would result in a substantial amount of data to describe the noise level for an hour or a day.

Therefore, it is desirable to describe a noise environment with a single number representing an hour or a day so that easy reference and comparisons can be made. Common methods which are widely used in California and throughout the United States

consider the average noise level and the maximum noise level recorded over a period of time, referred to as the L_{eq} and L_{max}, respectively. L_{eq} (equivalent level) is a single-number noise descriptor that represents the *average* sound level (during a one-hour period for example) in an environment where the actual noise level varies with time, and L_{max} is the *highest* noise level that occurred during that time.

Noise at VAFB is generated by automobile and truck traffic, aircraft landings and takeoffs, and space vehicle launches. Railroad traffic is also a significant on-base noise source. The existing noise level, L_{eq}, at ten different sites on-base and at nearby areas surrounding VAFB ranges from 48 to 67 dBA (USAF, 1992b), and is representative of background noise levels from vehicular traffic and other general community noises.

The nearest sensitive receptors potentially affected by noise generated during processing and integration of the satellite, and takeoff and landing of the L-1011, include a hospital, unaccompanied housing and accompanied housing. Bldg 1555 is located approximately three miles southwest from the hospital and accompanied housing area and 2.5 miles southwest from the unaccompanied housing area. The airfield is located approximately two miles southwest of the hospital and accompanied housing area and 1.5 miles southwest of the unaccompanied housing area.

During the initial seconds of various space vehicle launches from the launch corridor on VAFB, the maximum noise levels exceed 100 dBA in the vicinity of the sensitive receptors closest to facilities used during the proposed action. Launch noise is an infrequent and short duration noise source on VAFB. Maximum noise levels from the takeoff and landing of the L-1011, which will occur one time each for the rehearsal and launch, will be much less that the maximum noise levels associated with space vehicle launches.

Military aircraft routinely takeoff and land at the base airfield. These aircraft are not required to comply with the Federal Aviation Regulations pertaining to noise. The L-1011, however, is a commercial aircraft with new technology to reduce noise (Stage III type aircraft). This aircraft is much quieter than the military aircraft which currently use the airfield. Takeoff and landing of the L-1011 will not result in a change to the 24-hour L_{eq} noise levels at the closest sensitive receptors to the airfield. The L-1011 flight path will not overfly (within 2,000 feet) the hospital and housing areas during takeoff or landing.

Potential noise and sonic boom impacts associated with the Pegasus launch vehicle are discussed in the EA for the AFSLV (USAF, 1991). Since the AFSLV will be launched from an air platform, at an altitude of over 39,000 feet, no adverse noise or sonic boom effects are anticipated.

3.5 PUBLIC SERVICES, UTILITIES AND TRANSPORTATION

3.5.1 Public Services

Schools. The VAFB-related school population is concentrated in the Lompoc Unified School District (LUSD). The LUSD includes ten elementary schools, two middle schools, and two high schools. Most high school students attend Cabrillo High School in Vandenberg Village. Total enrollment for the LUSD was 10,521 as of December 1992, while adult education enrollment was 1,910. With the addition of portable classrooms over the past five years, the LUSD has ample classroom capacity, as do the Orcutt Elementary and Santa Maria Joint Union High School Districts (Bommerbach, 1993).

In February 1990, Santa Barbara County had a total public school enrollment of 50,173, which is below the 1970 peak enrollment of 61,818 students and less than the 54,459 students enrolled in 1977. During 1990, 25,387 students were enrolled in elementary school districts and 24,786 students in unified and secondary schools. The County also has 104 private schools with a total enrollment of 6,318 students (CDE, 1990).

There are several institutes of higher education in Santa Barbara County. The University of California at Santa Barbara had a total enrollment of 18,000 students in the fall of 1992 (Thompson, 1993). Santa Barbara City College and Allan Hancock College had total enrollments of 11,000 and 15,000 students, respectively, in 1991 (CDE, 1991).

Police Services. All police services for VAFB are provided by the Air Force, which has cooperative aid agreements with local area law enforcement agencies.

Fire Protection Services. All fire protection services are provided by the Air Force. The VAFB Fire Department has mutual aid agreements with local area fire districts.

Health Care Facilities. VAFB has a 40-bed hospital and outpatient treatment facilities. Santa Barbara County has numerous medical resources to support its residents, including two hospitals in the Santa Maria area and one hospital in Lompoc.

Recreation. Community parks, public beaches, golf courses, and wilderness areas are all found within the immediate vicinity of VAFB. These facilities offer a wide array of recreational activities, including swimming, boating, surfing, fishing, biking, hiking, camping, barbecuing, golfing, field sports, horse-back riding, and picnicking. Recreational areas on VAFB are available for active and retired military personnel and their dependants; however, these facilities are not available for the general public.

Recreational areas in the immediate vicinity of VAFB include Point Sal County Park, Ocean Beach County Park, and Jalama Beach County Park. Point Sal County Park, located north of the base boundary, is restricted to day use only. Ocean Beach County Park is located between North and South VAFB and is also restricted to day use. Jalama Beach County Park, located south of the base boundary, has overnight camping and a

concession area. Potential beach closures as a result of the launch are evaluated in the AFSLV EA and the Orbital Sciences Corporation (OSC) Commercial Launch Services Program EA (USAF, 1991 and OSC, 1993b).

3.5.2 Utilities

Power. The Southern California Gas Company provides natural gas to both the North County and South Coast areas of Santa Barbara County. North and South VAFB are served via an eight-inch gas main, capable of supplying 600,000 cubic feet per hour (cfh). Total natural gas consumption on North VAFB was 511,063,000 cubic feet in 1992, which is an average of 58,341 cfh (Johnson, 1993).

Electrical power is provided to VAFB by Pacific Gas and Electric (PG&E) and by on-base diesel-powered generating plants. Power from the PG&E plant in Morro Bay is transmitted along two 70-kilovolt (kV) lines to a single on-base metering substation. This substation and the entire on-base electrical infrastructure are owned and operated by the U.S. Air Force. At the substation, one power line connects to a 7,500-kilovolt ampere (kVA) transformer and the other line connects to a 10,000 kVA transformer. Power from the 7,500-kVA transformer serves the urban areas on-base, the street lighting system, and the base hospital, while the other transformer serves military operations (USAF, 1987).

VAFB has a system of diesel-powered generating plants that supplements PG&E's electrical supply and provides a backup for vital operations in the event of commercial power failure. The on-base system is anchored by seven generating plants which have capacities ranging from one to fifteen megawatts. The total capacity of these seven plants is 25.1 megawatts (USAF, 1987). There are also 39 medium-sized mobile units with a total capacity of 9.1 megawatts and 46 smaller portable units with a total capacity of 1.8 megawatts.

Total electrical consumption on VAFB was 183,250,000 kilowatt hours in 1989. Installation of an electrical power system at the Pegasus Hot Pad Loading Area to support launch preparation has been completed. Electrical consumption for processing and integration of the satellite will be of short duration and is expected to be minimal. No new additional sources of power will be required for the proposed action. Electrical power sources on the satellite are described in the STEP User's Guide (TRW, 1991).

Water. VAFB currently supplies over 99 percent of its own potable water, purchasing less than 0.5 percent from the adjoining Park Water Company. The base obtains its potable water from groundwater sources via wells on-base (see also discussion in Section 3.7.1, Hydrology).

Transportation, processing, and integration of the satellite is not expected to require large amounts of potable water. Potable water will only be for personnel use. The anticipated domestic potable water usage is less than 30 gallons per person per day. Water demand will be met from the existing VAFB water supply. Potable water

consumption, upgraded fire suppression systems, and upgraded sanitary facilities required at Bldg 1555 and the Pegasus Hot Pad Loading Area in support of launch operations are evaluated in the Commercial Launch Services Program EA (OSC, 1993b).

Wastewater. Wastewater generated by North VAFB is treated by the Lompoc Regional Waste Water Reclamation Plant (RWWRP). In 1992, administrative, housing, and industrial areas on North VAFB generated an average of 1.05 million gallons of wastewater per day (gpd), which was treated by the Lompoc RWWRP. This treatment facility provides secondary treatment and nitrification. It has a capacity of 5 million gpd and currently operates at just over 3.5 million gpd (Johnson, 1993).

The amount of wastewater that will be generated by the transportation, processing, and integration of the satellite is expected to be minimal. The only sources of wastewater expected will be from sanitary facilities at Bldg 1555. Unexpected sources may result from fire suppression or washdown water. Wastewater impacts at Bldg 1555 are evaluated in the Commercial Launch Services Program EA (OSC, 1993b).

Solid Waste. Santa Barbara County generates in excess of 2,000 tons of solid waste per day. This waste stream contains valuable resources such as glass, paper, metals and plastics which can be recycled, reducing environmental impacts associated with the production of new materials, in addition to extending the life expectancy of rapidly diminishing landfill space. Currently, almost all of this waste material is buried on a daily basis in seven landfills located around the county. Estimates for the life expectancy of county landfills indicate that within 30 years, by the year 2020, six of the seven landfills will have reached their full capacity. In addition, environmentally acceptable landfill replacement sites are scarce as well as expensive to bring into operation.

Nonhazardous solid waste generated from administrative, housing, and industrial areas on VAFB is disposed of at the VAFB Class III landfill. The landfill currently receives approximately 50 tons per day, or 1,100 tons per month, of municipal solid waste. Recycling of waste items such as paper, plastic, aluminum and plastic also occurs at various locations on VAFB.

Solid waste generated at Bldg 1555 is collected and disposed of by the base contractor, Federal Disposal Service. Nonhazardous solid waste generated by the proposed action will include packaging material from shipping. Typically, about two dumpsters of packaging material waste are generated during one satellite processing (estimated total weight of less than one-half ton). Some of the shipping containers are reusable.

3.5.3 Transportation

Transportation in the VAFB region is provided by highway and rail systems. State and local roads provide highway service for the county. Principal routes are State Highways 1, 135, and 246. State Highway 246 ends at the west city limits of Lompoc, and is called West Ocean Avenue from the city boundary west to the coast. Roadways in the VAFB

area are generally at Level of Service C (stable flow but maneuverability limited by high volume) or better, except in a limited number of locations (USAF, 1992b). The section of Highway 1, known as H Street, in downtown Lompoc frequently operates at Level of Service D (approaching unstable flow, affected by fluctuating high traffic volume) during peak traffic periods (USAF, 1988).

Three railroads provide service in the vicinity of VAFB: the Southern Pacific, Santa Maria Valley, and Ventura County Railroads. The Southern Pacific Transportation Company line serves as the main line of the Los Angeles to San Francisco coastal rail transportation corridor. Freight service is provided to most cities along the coast. AMTRAK passenger service is also available. The Ventura County Railroad connects the Southern Pacific main line in Oxnard with the harbor facility at Port Hueneme. The Santa Maria Valley Railroad connects the Southern Pacific main line to the Santa Maria Valley.

The Southern Pacific tracks on VAFB pass between the airfield and the coastline (see Figure 2-2), and are overflown during takeoffs and landings. To minimize the potential risk to people and property, trains are not subject to overflights of launch systems. An electronic surveillance system, posted schedules, and close coordination are used to minimize the possibility of overflight (USAF, 1988). Actual launch of the Pegasus XL, with the mounted STEP M1 satellite, will occur as an air platform launch over the ocean. The launch will not overfly the rail line.

3.6 SOCIOECONOMICS

3.6.1 Population

The population of Santa Barbara County was 298,700 in 1980. It increased at an annual rate averaging approximately 2 percent per annum from 1980 to 1988. The current population of Santa Barbara County is estimated at 369,608. The City of Santa Barbara (pop. 85,571), in the South Coast region, is the area's largest incorporated community. Santa Maria (pop. 61,284) and Lompoc (pop. 37,649) are the principal communities in north Santa Barbara County. The north County area increased by 20 percent between 1980 and 1985, while the South Coast area increased by about five percent (USAF, 1989c). The current population of Santa Barbara County is expected to increase by approximately 10 percent by 1995.

As the regional aerospace industry has grown over the last 30 years, activities at VAFB have influenced population growth patterns in Santa Barbara County during this period. The working population at VAFB was 15,016 in 1986, an increase of more than 4,600 from the population ten years earlier. These figures are down substantially from the mid-1960's, when the VAFB working population was above 18,000 (USAF, 1988). The working population of VAFB is currently estimated at 8,801 (DeLima, 1993).

The proposed action will not increase regional population. It is expected that no more than 20 temporary operational personnel will be required for the proposed action. These employees will be required to be on VAFB during transportation, processing, integration, and launching of the satellite.

3.6.2 Housing

VAFB has 2,741 family housing units and space for 172 mobile homes. In 1985, the estimated number of housing units in Santa Barbara County was 131,000, an increase of over 20 percent above the 1980 level of 109,000. The number of housing units increased more rapidly in the North County area than the South Coast area during this period. This resulted from the population growth and increased economic activity in the North County area and housing constraints, such as building moratoria and high costs, in the South Coast area (USAF, 1989a, 1989c).

The estimated number of housing units in Santa Barbara County is expected to increase from 138,149 in 1990 to 142,900 in 1995 (CDF, 1989). In 1987, Santa Barbara County had approximately 8,500 temporary housing units, such as hotels and motel rooms. Vacancy rates currently range between two and five percent, with the higher rates generally being in North County (USAF, 1989c).

Vacancy rates for housing in Lompoc was 6.27 percent, with a vacancy rate of three percent for single-family residential units, six percent for condominiums, and approximately 11 percent for apartments. The average apartment rental for a 2-bedroom apartment was approximately $575 per month (Martin, 1990).

3.6.3 Employment

VAFB is a source of major economic influence in northern Santa Barbara County and the Lompoc Valley. Approximately 40 percent of the Lompoc Valley and nine percent of the Santa Maria Valley labor forces are employees at VAFB (USAF, 1989c).

In 1987, direct and indirect employment related to VAFB in Santa Barbara and San Luis Obispo Counties was estimated at approximately 15,400 (USAF, 1989c). This included 11,100 jobs on-base, as well as 4,300 jobs in the general community. The latter is attributable to expenditures of both VAFB employees and VAFB agencies. In addition, since much of the hardware needed for military and aerospace operations at VAFB comes from outside the Lompoc-Santa Maria area, some expenditures occur outside the local area (USAF, 1989c). In 1987, an additional 5,100 jobs outside of Santa Barbara and San Luis Obispo Counties were attributable to VAFB-related expenditures (USAF, 1989c).

Current military employment at VAFB is approximately 3,180 (DeLima, 1993). In addition, 1,304 civilian personnel, not including those employed by contractors, are employed on-base (DeLima, 1993).

Total current employment in Santa Barbara County is 173,300, with an unemployment rate of 4.2 percent (CDF, 1990). The total employment of Lompoc is 16,068 (Martin, 1990).

3.7 HYDROLOGY AND WATER QUALITY

3.7.1 Hydrology

The Santa Ynez River forms the geomorphic boundary between North and South VAFB. The river stretches 70 miles from its headwaters in the Santa Ynez Mountains to a one-mile long lagoon at its terminus near the Pacific Ocean. The natural flow has been severely altered by several dams. The average flow rate is 51.5 cubic feet per second (cfs), measured near the terminus. Although it is a perennial stream in the Lompoc plain, the volume of flow is usually small. During the summer months, flow is maintained by irrigation return and treated sewage effluent. The Santa Ynez River on Base is a 100-year flood plain. Bldg 1555 and the runway are not located within the flood plain.

Canada Tortuga Creek is located approximately 2,000 yards north of Bldg 1555. The facility is located on a terrace above the creek. The terrace is comprised of highly permeable dune sand, and most surface water percolates rapidly into the subsurface (OSC, 1993b). The Pacific Ocean is located approximately 6,000 feet west of the facility.

The Pegasus Hot Pad Loading Area is located adjacent to the main VAFB airfield. Natural drainage contours in this area have been altered during previous runway construction. During storm events, rapid sheet flow runoff may occur on paved surfaces. Stormwater runoff percolates rapidly into the soils in the area around the airfield.

The wet season for the VAFB area is from December to April. The average annual precipitation is 14.4 inches. The wettest month is usually February, when most of the extratropical storms from the southwest move inland. The mean monthly precipitation for February is 2.9 inches. July is usually the driest month, when there is no mean monthly precipitation.

The San Antonio Valley Basin is the primary groundwater basin on North VAFB. VAFB has four production wells in the valley (USAF, 1992b). Total water production in 1992 was 1,306.2 million gallons (Johnson, 1993). The basin contains an estimated 8.5 million acre-feet of groundwater in permanent storage above sea level (ESA, 1982). The basin is independent and not hydraulically connected to other groundwater basins in the region. Recharge results from percolation of rainfall and surface runoff. It is estimated that, given the current rate of water production, the aquifer is capable of supplying water for the next 100 years (Johnson, 1993). Although the aquifer has a calculated capacity for the next 100 years, it is severely overdrafted. Irrigation water for agriculture is the secondary use of groundwater from this basin.

3.7.2 Water Quality

Watersheds are subject to on-base construction and agricultural runoff. The Santa Ynez River also receives off-base agricultural runoff, resulting in elevated dissolved solids, phosphates and nitrates. Surface water is not directly used as a potable water supply at VAFB.

Groundwater has historically been the main source for agricultural, municipal and military water supply in the VAFB region. Groundwater monitoring is conducted for basins which are utilized for drinking water. The San Antonio Basin currently exceeds drinking water standards for total dissolved solids, manganese and iron (USAF, 1992b).

3.8 NATURAL RESOURCES

Land use on VAFB is characterized by a central urbanized area on North VAFB, scattered launch, test, and tracking facilities at North and South VAFB, and open space. Open space accounts for 88,025.5 acres, or 89.6 percent of all base land area (GRW, 1989). Much of the open space on VAFB is divided into Agricultural Management Areas (AMA). The Base has six AMA which include a total of 55,226 acres of rangeland and 1,162 acres of cropland (USAF, 1987). There are approximately 575 acres of prime agricultural land near the Santa Ynez River which is leased by competitive bid. The remainder of the open space is comprised of natural areas, such as dunes, floodplains, wetlands, bluffs, and beaches.

Mineral resources of economic potential identified at VAFB include oil and gas, diatomite, and limestone (USAF, 1980). Of these mineral resources, potential oil and gas reserves have the most significant commercial value. In 1987, a Mineral Resource Management Plan (MRMP) was developed for VAFB (USAF, 1987). The MRMP provides a detailed discussion of potential exploration, development, and existing mineral and petroleum extraction operations on VAFB.

The VAFB airfield is located on an area with low petroleum reserve potential. This low potential area extends south from San Antonio Creek to the Santa Ynez River. A total of seven wells have been drilled in this area and all of them are dry (USAF, 1987). None of these dry wells are located in or adjacent to the airfield.

3.9 ENERGY

Energy requirements for the STEP M1 launch are mainly for support and launch operations, identified in Section 3.1. These operations will require diesel and jet fuel (JP-4) for the aircraft. Energy requirements are presented in Table 3-2.

Table 3-2
STEP M1 Energy-Related Requirements

	Energy Consumption per launch (gallons)	
Equipment	**Diesel**	**JP4**
Forklift	3.3	--
Truck	3.6	--
Hydraulic Lift	3.3	--
L-1011	--	14,950
F-16	--	4,057

Note: Aircraft energy related requirements include both the rehearsal and launch flights

3.10 VISUAL RESOURCES

Vandenberg AFB offers a variety of scenic vistas, which include rolling hills covered with oaks and chaparral vegetation, valleys, floodplains, beaches, and dramatic ocean cliffs. Topography is dominated by the east-west trending Santa Ynez Mountains, which narrow toward the coast and terminate at Point Arguello (USAF, 1989d). The main on-base viewpoints are from the primary roads on North VAFB and Coast Road on South VAFB. None of these roads are accessible to the public, but they do offer scenic viewsheds to base personnel.

The nearby city of Lompoc is characterized by sprawling urban and commercial development, surrounded by scattered residences and agriculture. The Santa Ynez River provides drainage for the Lompoc Valley, with its terminus in the ocean. Due to access limitations and intervening topography, views of the coastline are generally not available from inland locations (GRW, 1989).

Visual impacts as a result of construction and operation at Bldg 1555 and the Pegasus Hot Pad Loading Area are addressed in the Commercial Launch Services Program EA (OSC, 1993b). No adverse impact to visual resources at either of the two locations was anticipated.

SECTION 4

ENVIRONMENTAL CONSEQUENCES

SECTION 4

ENVIRONMENTAL CONSEQUENCES

This section presents a discussion of the potential environmental impacts that could result from implementation of the proposed action and the no action alternative. The evaluation focuses on the impacts that are considered significant. Mitigation measures that would prevent or minimize the impact to a level of insignificance where possible are identified in this section.

Vandenberg Air Force Base (VAFB) is the location from which intercontinental ballistic missiles and polar-orbiting space satellites are launched. The Space Test Experiments Platform (STEP) M3 (third mission) is planned for 1994 - 1995, and there are also other ongoing launches and various testing and tracking projects on base. However, there are no related projects planned or reasonably foreseen in the vicinity or duration of the proposed action. Subsequent missions of the STEP or Air Force Small Launch Vehicle (AFSLV) may be planned for VAFB or other locations in the future. Each of these other actions would be subject to separate environmental reviews as required. For the most part, each of these actions would result in intermittent and short-term impacts to the environment. For these reasons, cumulative impacts of the proposed action are not anticipated or further discussed in this Environmental Assessment (EA).

4.1 NO ACTION ALTERNATIVE

Under the no action alternative, existing facilities planned for use by this program would not be used. The environmental resource areas discussed in Section 3 would not be affected, and no adverse impacts would occur. Because of the minimal and less than significant impact of the proposed action (discussed below under subsection 4.2), their avoidance by the no action alternative does not present a substantial environmental advantage. The primary disadvantage of the no action alternative would be the inability to collect the needed scientific data.

4.2 PROPOSED ACTION

4.2.1 Air Quality

This section describes air pollutant emissions attributable to support and launch operations for the Space Test Experiments Platform Mission 1 (STEP M1).

- **Ground Support Operations**

The STEP M1 satellite will be delivered to Vandenberg Air Force Base (VAFB) by truck. Upon delivery to Building (Bldg) 1555, the Vehicle Integration Facility, it will be unloaded to the processing area using a forklift. Following inspection and validation tests, the satellite will be fueled with hydrazine and encapsulated. Hydrazine transfer to the

payload is completed via a closed loop system which includes a scrubber to control fugitive emissions of hydrazine.

The encapsulated satellite will be integrated with the Pegasus XL launch system at Bldg 1555. The integrated payload/launch vehicle assembly will then be moved by truck on a trailer to the Pegasus Hot Pad Loading Area. There, it will be unloaded using a crane or a hydraulic lift, and carefully moved for attachment to a Lockheed L-1011 for an air launch.

The attachment of the STEP M1 assembly to the aircraft will be conducted over a three-day period at the hot pad area. Power for the attachment operations and air conditioning at the hot pad area has been installed. No generators will be required for the proposed action.

Operations described above result in emissions to the atmosphere. Emissions from payload and payload/launch vehicle movement consist of combustion products from transport trucks. There are also minimal amounts of isopropyl or denatured alcohol from wipedowns. Emissions from these operations for a single STEP M1 launch are presented in Table 4-1.

Table 4-1
STEP M1 Ground Support Operations Emissions

	Emissions, lbs/launch					
Activity	**CO**	**HC**	**NO_x**	**SO_x**	**PM**	**N_2H_4**
1. Forklift unloading	0.18	0.05	0.44	--	0.03	--
2. Alcohol wipedown	--	6.57	--	--	--	--
3. Hydrazine transfer	--	--	--	--	--	1.70
4. Assembly truck transfer	0.30	0.08	0.65	--	0.15	--
5. Hydraulic lift for attachment	6.50	0.15	1.55	0.10	0.08	--
TOTAL EMISSIONS	**6.986.85**	**2.64**	**0.10**	**0.26**	**1.70**	

Source: Engineering-Science

CO - carbon monoxide
HC - hydrocarbons
NO_X - nitrogen oxides
SO_X - sulfur oxides
PM - particulate matter
N_2H_4 - hydrazine

1 - Based on 1-hour operation of a diesel-fueled 50-horsepower forklift
2 - Based on maximum use of 1 gallon of isopropyl alcohol
3 - Based on a control system efficiency of at least 99 percent
4 - Based on a maximum 20-mile roundtrip
5 - Refer to OSC, 1993b

- **Launch Operations**

Emissions from launch operations that affect surface air quality are attributable only to the landing and takeoff of the L-1011 from which the Pegasus XL launch vehicle and the STEP M1 payload will be launched. Emissions for the AFSLV were previously quantified and addressed in USAF (1991). However, that analysis was based upon use of a B-52 aircraft. As discussed in subsection 2.5.2, use of the B-52 aircraft for the proposed

action is not possible, because the longer and heavier Pegasus XL was not designed or manufactured to be carried by the B-52. Therefore, emissions for the launch operations associated with the proposed action were developed, and are presented in Table 4-2.

Emissions from the ground-based and launch-based operations associated with the STEP M1 project, as presented in Tables 4-1 and 4-2, are minor. As discussed in Section 6, aircraft launch operations are exempt from permit requirements. A comparison of the launch emissions from the proposed action with other launch operations at VAFB is not possible, since cumulative launch emissions have not been quantified for the base. Ground support emissions are expected to receive a de minimus exemption, since they are not expected to exceed VAFB's aggregate limit (see discussion in Section 6.1). Since this exemption has not yet been approved, it is not possible at this time to quantify the proportion of the emissions from the proposed action in terms of the allowable VAFB permit limit. The overall STEP M1 emissions will contribute to local air pollution and the potential degradation of local air quality. These emissions are minor in quantity and generated during a very short period of time at a location that is isolated from the general public, with virtually no impact on local air quality.

Table 4-2
STEP M1 Launch Operations Emissions for Rehearsal and Launch

	Emissions, lbs/launch				
Activity	**CO**	**HC**	**NO_x**	**SO_x**	**PM**
L-1011 Landing/Takeoff Cycle[1]	708	498	126	13	NA[2]
F-16 Landing/Takeoff Cycle[3]	54	3	30	2	0.5
Total Emissions	762	501	156	15	0.5[2]

Source: Engineering-Science

[1] Based on EPA AP-42 emission factors and one landing/takeoff cycle each for rehearsal and launch

[2] No PM emission factors are available for the L-1011

[3] EPA AP-42

4.2.2 Global Climate Change and Stratospheric Ozone Depletion

Four types of emission scenarios exist for the launch of the STEP M1 satellite. The first is the emissions from surface operations that will contribute greenhouse gases and ozone-depleting compounds into the atmosphere. Given enough time, emissions from these sources will eventually migrate into the stratosphere. The second scenario, similar to the first, is emissions from a launch within the troposphere that may migrate into the stratosphere. The third scenario is a direct injection of emissions by a launch vehicle passing through the stratosphere. Finally, the fourth is the potential deposition of materials from the satellite into the stratosphere with reentry and breakup of the satellite.

The dimensions of the orbit are such that the satellite booster emissions will remain well above the stratosphere.

Quantities of the exhaust products of the solid-propellant rocket motors (SRMs) used in the Pegasus XL are not directly known but can be estimated using the nature and ratio of exhaust products from similar vehicles that use the same launch propellants, oxidizers and other chemical components that have been widely studied. The information presented here was obtained by comparing data from the Pegasus launch vehicle (USAF, 1989a; OSC, 1993b) to the most currently available information on the Pegasus XL (OSC, 1993b).

The Pegasus XL will use three stages of SRMs to boost the payload into an initial orbit of 165 x 750 kilometers (km). Four one-pound hydrazine-powered thrusters will then be used to boost the spacecraft into a final orbit of 175 x 1,500 km. These thrusters will also be used to maintain the orbit, since the low perigee will result in significant drag and continually lower the orbit energy. As a conservative estimate of the emissions, all combustion and ground-related operation emissions are assumed to eventually migrate into the stratosphere. Thus, the impact on global climate change and stratospheric ozone depletion will include surface, launch vehicle transport using the L-1011 aircraft and rocket motor emissions.

- **Emissions of Greenhouse Gases and Ozone Depleting Compounds**

To calculate the quantity of greenhouse and ozone-depleting compounds emitted into the troposphere during the STEP M1 launch, the tropopause (boundary between the troposphere and stratosphere) was assumed to be approximately 15 km (49,000 feet), and the upper stratospheric boundary was assumed to be 50 km (164,000 feet). These altitudes are consistent with calculations made by Prather et al., (1990) and NASA (1990). From the flight profile presented in USAF (1989a) for the Pegasus, the tropopause would be reached shortly after launch during the first stage burn. This first stage burn will carry the launch vehicle to about 68 km (223,000 feet) and above the stratosphere. For purposes of this analysis, we have therefore assumed the only launch emissions that would contribute to potential global climate change or ozone depletion would be the L-1011 Pegasus carrying aircraft and the first stage SRM. This first stage SRM accounts for over 75 percent of the total solid propellant carried by the Pegasus XL.

The following analyses are based on the launch of the STEP M1 satellite from the airborne platform. The total estimated emissions for the two compounds that have the greatest impact on global climate change and ozone depletion, carbon monoxide (CO) plus carbon dioxide (CO_2) and hydrogen chloride (HCl), respectively, are shown along with other constituents in Table 4-3. The CO is significant because it is anticipated that CO will rapidly oxidize to CO_2 due to initial high temperatures and the abundance of oxygen.

Table 4-3
Emissions of Greenhouse and Ozone-Depleting Compounds During the Launch of the STEP M1 Satellite

Combustion Product	L-1011 Emissions (tons)	F-16 Emissions (tons)	SRM Exhaust (tons)	Total Launch (tons)
CH_4[a]	--	--	--	--
$CO_2 + CO$[b]	--	--	3.88	3.88
HCl --	--	2.98	2.98	
H_20 --[d]	--[d]	1.42	1.42	
N_2[c] --	--	1.32	1.32	
NO_x	1.0[e]	0.5[f]	1.35	2.85

a Exhaust emissions are assumed to be minimal

b The emitted CO from the SRM will be rapidly converted to CO_2 due to the high initial temperature and abundance of oxygen. CO from the L-1011 is assumed to remain as CO and is not included.

c For worst case assumption, N_2 here has all assumed to be a precursor to N_2O

d Water vapor emissions for the L-1011 and F-16 were not available. These are assumed to be insignificant.

e The NO_x was calculated using EPA AP-42 emission factors using an assumed 163.4 minute flight time composed of 32.8 minute taxi, 0.7 minute takeoff, 40 minute climb, 35 minute cruise, 40 minute approach and 14.9 minute final taxi

f The NO_x was calculated using EPA AP-42 emission factors for the landing takeoff cycle plus the 40 minute climb, 35 minute cruise and 40 minute approach.

The total propellant weight of the first stage of the Pegasus XL SRM in the launch is 15,052 kilograms (OSC, 1993b). Emissions were obtained by scaling the emission rates for the Pegasus (USAF, 1989a) by the increased solid propellant weight of the first stage of the Pegasus XL.

Emissions from ground support activities that are directly attributable to the launch of the STEP M1 satellite and would contribute to the greenhouse effect and deplete the ozone layer are considered insignificant relative to the actual launch emissions. Surface emissions of these gases may include internal combustion sources that produce water vapor, CO_2, methane (CH_4) or nitrogen compounds, as well as operations that could release chlorofluorocarbons (CFCs). These operations include the use of air conditioning and fire protection systems and solvents that would potentially contain ozone-depleting compounds, CH_4, and substances that would lead to the formation of nitrous oxide (N_2O). These substances are known as N_2O precursors. The major assembly and related activities will be performed off-site and are detailed in the Pegasus EA (USAF, 1989a).

Upon satellite reentry, the only materials expected to survive will be the titanium fuel tank (Aerospace, 1991). Research is currently under way to assess the potential impact of the alumina particles deposited above about 50 miles (80 km) from vehicle breakup on reactions in the stratosphere and associated disturbances in stratospheric ozone concentrations. It is recognized that the alumina particles are extremely active surfaces

for chemical reactions, but the effect on ozone depletion is still under study (USAF, 1993b).

- **Comparison of STEP M1 to Global Emissions**

The average global stratospheric ozone-depletion rates for the types of chemicals that would be emitted by a Pegasus XL and associated L-1011 flight were calculated as a percent effects per ton of emission. For each ton of chlorine emitted, a 2.5 x 10^{-5} percent reduction of stratospheric ozone would occur (Brasseur and Solomon, 1986). For each ton of nitrogen oxides emitted, a 1.00 x 10^{-6} percent reduction of ozone would occur (Brasseur and Solomon, 1986). The calculated depletion of stratospheric ozone is included in Table 4-4.

Table 4-4
Calculated Depletion of Stratospheric Ozone Resulting from Launch of the STEP M1 Satellite

Combustion Product	Total Launch Emissions (tons)	Global Emissions (tons/yr)	Fraction of Global (%)	Reduction in Stratospheric Ozone (%)
CH_4[a]	--	1.1 x 10^4 tons[b]	--	--
CO_2 + CO[c]	3.88	5.5 x 10^9[b]	7.1 x 10^{-8}	--
HCl	2.98	3 x 10^5	9.9 x 10^{-4}	7.5 x 10^{-5}
H_20	1.42	1.4 x 10^{14} tons[b]	1.0 x 10^{-12}	--
N_2[d]	1.32	2.8 x 10^3[e]	4.6 x 10^{-2}	1.32 x 10^{-6}
NO_x	2.85	--	--	2.85 x 10^{-6}

a Exhaust emissions are assumed to be minimal

b Source: USAF, 1991, atmospheric background

c The emitted CO from the SRM will be rapidly converted to CO_2 due to the high initial temperature and abundance of oxygen. CO from the L-1011 is assumed to remain as CO and is not included.

d For worst case assumption, N_2 here has all assumed to be a precursor to N_2O

e Global emissions of N_2O

The exhaust products released in the troposphere and stratosphere from the Pegasus XL first stage SRM will cause ozone depletion as a result of the release of hydrogen chloride HCl. HCl is produced in the combustion of solid propellants during launch. It is assumed that all of the chlorine in the oxidizer is released as, or rapidly transformed into, HCl. It is estimated that the launch will result in approximately three tons of HCl to be emitted into the stratosphere and below during the launch. This HCl is all assumed to eventually migrate into the stratosphere and deplete the stratospheric ozone concentrations by 7.5 x 10^{-5} percent.

N_2O is not a specific exhaust product of the SRM. Potential precursors are present, some of which may catalyze ozone depletion. Assuming, conservatively, that all of these

emissions become N_2O, the emissions associated with the launch, including N_2 and NO_x will contribute approximately 4.2×10^{-6} percent to the total ozone depletion.

Water vapor will be an exhaust emission product of the L-1011 and the SRM. Water vapor has both a warming and a cooling effect on global temperatures. Thus, it is uncertain, at this time, what the net effect this will have on global climate change. By most estimates, however, the STEP M1 contribution of this gas should be considered negligible.

Tropospheric ozone formation may result from the launch of the Pegasus XL and associated L-1011 exhaust product emissions. However, relative amounts cannot quantitatively be estimated with the information available and the uncertainty of the photochemical modeling tools.

- **Impact Summary**

The emissions of greenhouse and ozone-depleting compounds from the STEP M1 launch will have an impact on the tropospheric and stratospheric concentrations of these compounds. The significance of the impact on global climate change is unknown because of the current state of knowledge on the interaction and effects of the different gases on whether the total effect will be for global warming or cooling. The significance of the effect of space launches on ozone-depleting compounds is more quantifiable. With the phase-out of ozone-depleting compounds under the Montreal Protocol and Clean Air Act Amendments of 1990, and the recent push for an accelerated phase-out schedule (Parkin and Soong, 1992), the fraction of ozone-depleting compounds attributable to space launches will increase dramatically (Aerospace, 1993). However, even though the fraction contributed by the space launches will increase, the launch impact on the total ozone burden will remain small. This is because even if a total ban on ozone-depleting chemicals were to be implemented immediately, the effects of past chemical emissions would linger for the next 20 years (Parkin and Soong, 1992).

Changes in the levels of stratospheric ozone, which result in an increased incidence of ultraviolet (UV) light radiation at the surface of the earth, have given rise to concerns about a wide variety of health and environmental impacts, including increases in incidences of human cancers and cataracts, suppression of human immune systems, to name a few (EPA, 1988; NASA, 1978). Estimating changes in these areas of concern from stratospheric ozone-depletion is difficult due to uncertainties in estimating baseline ozone-depletion and translating these depletions to the increased incidence of UV radiation at the surface of the earth, and a lack of understanding of the various human and environmental dose/response mechanisms. For non-cancer related impacts, uncertainties are such that the impacts from the proposed action cannot be numerically estimated.

A major effort over the last several decades has been to understand the results of human epidemiologic studies that have investigated the relationship between various forms of skin cancer and increased UV radiation. The EPA has used the results of these

studies to support its rulemaking on the protection of stratospheric ozone, concluding that it may be reasonably anticipated that an increase in UV radiation caused by a decrease in the ozone column would result in increased incidences of skin cancer. In addition to the conclusions reached by EPA, other analyses have been published which acknowledge the adverse relationship between reduced stratospheric ozone and increased cancer incidences (Shea, 1988; Van Der Leun, 1986).

The total tropospheric and stratospheric emissions of ozone-depleting compounds resulting from the STEP M1 launch will reduce the stratospheric ozone by about 7.9×10^{-5} (0.000079 percent).

4.2.3 Waste Management

Waste management will be handled according to existing waste management procedures on VAFB (see discussion below and in Section 4.2.5).

- **Toxic and Hazardous Waste**

Minor amounts of hazardous waste would be generated by STEP M1 processing at VAFB. Approximately one 55-gallon drum of waste, including epoxy and rags contaminated with the cleaning agent isopropyl alcohol, is generated during processing of a satellite. This waste will be handled and disposed as hazardous waste. Additionally, rinseate waste generated during cleaning of the hydrazine transfer equipment, which is not expected to exceed the volume of one 55-gallon drum, is considered a hazardous waste. These two drums of hazardous waste generated during processing of the STEP M1 satellite would represent approximately 0.8 percent of the average volume of hazardous waste generated on VAFB during the same period (approximately 250-300 drums per month). The volume of hazardous waste anticipated to be generated by the proposed action can be accommodated by the existing hazardous waste handling and disposal system on VAFB.

Protective clothing used during satellite processing will be washable and reusable, rather than disposable. Cleaning of the protective clothing, if needed, during and following processing activities will be done by contractor personnel at Bldg 1555. If the clothing needs to be disposed, it will be placed with the other waste generated during satellite processing, and properly disposed as hazardous waste.

There is a potential for spills from all buildings and where hazardous materials are used. Spilled material, excluding hydrazine, will be placed in containers, and transported to the designated Collection Accumulation Point by processing personnel. Bldg 1555 is equipped with a emergency above ground storage tank, located outside of the building, to collect any large spills of hazardous waste. Emergency response in the event of a hydrazine spill would be handled by Jacobs Services Company, which has the specialized equipment necessary (i.e., Self-Contained Atmospheric Pressure Ensemble [SCAPE] suits), and are under contract with the base for such situations. Any hazardous waste in

the above ground storage tank would be removed by contractors personnel and properly disposed as hazardous waste.

Hydrazine release from the fueled satellite during pre-launch activities, including transfer to the Hot Pad, mounting of the AFSLV onto the L-1011, and aircraft takeoff, is considered unlikely, and would only occur in the event of a structural failure of the satellite's tank system. A fall from the level of the AFSLV assembly integration trailer or the L-1011 would not likely cause such a system failure.

Protective measures minimizing or eliminating the impacts of hazardous materials used on the satellite and in its processing have been considered and incorporated into design and procedures (DSI, 1993). These are briefly described below.

NiCd. The nickel cadmium batteries will have been installed on the satellite prior to its arrival at VAFB. The batteries can be removed and replaced, if required, on the satellite during processing operations. Engineers and technicians assigned to work on the satellite during processing are familiar with the battery connectors and safety issues.

Ammonia (Gas). Only a small amount of ammonia gas is contained in the heat pipes within the satellite, which are inaccessible to personnel during processing operations. Even under conditions of a burst type leak, which releases all the gas simultaneously, the gas would dissipate to harmless levels by the time it actually exited the confines of the satellite (DSI, 1993). Once in the open area of Bldg 1555 ammonia gasses would be removed from the area by the air handling system.

Radium 226. The 1.6 microcurie Radium source in solid chip form is mechanically embedded in an airtight sealed experiment sensor within the core module of the satellite. Because of the small quantity (approximately the same amount contained in household smoke detectors), and its total inaccessibility to those working on the vehicle during processing, no impacts are expected.

Gaseous Nitrogen or Helium. Normal area ventilation and the two person rule (at lease two persons present in the work area at any time) prevent the possibility of adverse effects from total air displacement by leaking nitrogen or helium.

Hydrazine. Fueling of the satellite has been delayed to the latest possible time during satellite processing, approximately one week before launch. Because of the toxicity and volatility of hydrazine, all pertinent safety precautions (temporary evacuation of nonessential personnel, use of protective gear) shall be in force, in accordance with Occupational Safety and Health Administration 29 CFR 1926, and Air Force Occupational Safety and Health standards 161-xx (Health) and 127-xx (Safety). Hydrazine loading plans and procedures for fueling of the satellite are currently being prepared by TRW. These procedures will be finalized and accepted by the Air Force (Headquarters Space and Missile Systems Center) before processing at VAFB. The following procedures will be included as part of the fueling procedure: one ambulance with attendant shall be on standby at the closest medical facility; one fire truck with crew

shall be at Bldg 1555; fueling shall be performed by a minimum three person crew; personnel shall be attired as directed by the designated safety officer during propellant transfer operations, including wearing SCAPE suits with supplied air before pressurizing hydrazine containers, starting propellant flow, or when disconnecting lines; personnel working on propellant systems must be physically qualified for hazardous propellant; and, the atmosphere must be continuously monitored for hydrazine and hydrazine by-products during and after fueling operations. These safety measures reduce potential effects from leakage or spills during fueling to an acceptable level.

Isopropyl Alcohol. Isopropyl alcohol is not considered hazardous, unless consumed by drinking. The poisonous nature of this cleaning agent will be indicated on its storage container, and no significant impacts are anticipated.

- **Pollution Prevention**

Pollution prevention opportunities have been identified and pursued. The types of solvents used for cleaning operations have been consolidated, and the least hazardous solvent that will perform the desired function has been selected. Procedures for processing of the STEP M1 satellite at VAFB have been developed to minimize the amount of pollution and waste to be generated.

4.2.4 Noise

The major noise source for the proposed action is launch noise. Other noise sources in the Hot Pad area are minor in comparison to the launch noise of an aircraft. Processing-related activities will be conducted inside Bldg 1555. These activities ware typical for an industrial facility. All required noise control measures will be implemented at the processing facility to meet worker noise exposure limits specified by the Occupational Safety and Health Administration and Western Range Regulation 127-1. Due to the distances involved, normal processing activities will not result in any noise impacts at the sensitive receptor locations. Takeoff and landing of the L-1011 aircraft, during both rehearsal and actual launch, will not result in a significant change in noise levels at the closest sensitive receptors to the airfield.

4.2.5 Public Services, Utilities and Transportation

The proposed action will not require any new community facilities such as schools or health care facilities. No impacts on public safety services (police and fire) are expected. VAFB provides its own police and fire protection. Transportation services and traffic on-base will not be impacted from transportation of the satellite or L-1011. Recreation areas will not be affected by transportation, processing, and integration of the satellite.

The proposed action will not require new utility services to be built. Water and electrical demand will be met with existing VAFB capabilities. Wastewater will also be handled within existing capabilities on-base. Any wastewater generated will be negligible

and will not affect groundwater or surface water in the area. All utilities required by the proposed action will be temporary.

Nonhazardous solid waste generated by the proposed action can be handled by the existing sanitary landfill on-base. It is estimated that less than one-half ton of solid waste will be generated over the duration of the processing and pre-launch period (approximately 30 days). This volume is approximately 0.045 percent of the average volume received at the base landfill during the same period. The estimated volume of nonhazardous solid waste generated by the proposed action can be accommodated by the existing facility on-base.

The movement of project-related vehicles along existing highways and surface streets will occur as part of the proposed action. Transport of the STEP M1 satellite from its manufacturer to VAFB is described in subsection 2.3.1, Satellite Component Transport. Transportation of the satellite requires special handling, routing, and timing, but will not significantly affect traffic flow. No caravan-type movement will occur. Approximately 20 additional daily vehicle trips between Lompoc and VAFB by temporary launch operation personnel are anticipated. These additional vehicle trips will be limited to the launch processing and launch phase of approximately 30 days. These trips will not result in impacts to traffic patterns in the vicinity of, or on, VAFB.

4.2.6 Socioeconomics

- **Population**

Population will not be permanently increased as a result of the proposed action. The additional 20 personnel required for processing and launch of the satellite will be temporary. Therefore, no impacts to population are expected.

- **Housing**

The proposed action will have no impact on housing, since the temporary personnel required to launch the satellite will not be permanent.

- **Employment**

No permanent increase in employment will result from transportation, processing, and integration of the satellite. The proposed action will not change the nature of the labor force. Temporary employment associated with satellite processing is small in relation to Santa Barbara County's overall economic context; therefore, no adverse effects on employment are expected.

4.2.7 Hydrology and Water Quality

- **Hydrology**

Due to the high permeability of the surrounding soils, surface water in the vicinity of Bldg 1555 and Hot Pad Loading Area does not drain into Canada Tortuga Creek via

overland flow. The surface areas of Bldg 1555 and Hot Pad Loading Area are impervious, consisting mainly of concrete and asphalt. No additional surface water will be generated or discharged as a result of normal processing and launch activities for the STEP M1.

No groundwater or potable water other than for personnel use is required for STEP M1 processing at VAFB. The Air Force estimates that 20 persons will be temporarily required for processing and launch of the STEP M1 satellite, over a period of 30 days. Some personnel may be required to stay beyond this period to ensure that all waste is properly processed and disposed. The anticipated domestic potable water usage is less than 30 gallons per person per day. Fire suppression water may be used in case of an accident or emergency. Water demand will be taken from the existing VAFB supply. Since there will be no permanent increase in residential population on-base associated with STEP M1 processing and launch, and the domestic water requirements for the temporary personnel are within available capacity, no adverse impact on groundwater is expected.

- **Water Quality**

Potential adverse impacts from the proposed action on the local surface water and groundwater quality could result from accidental spills of hydrazine propellant and other chemicals in Bldg 1555 or at the Hot Pad, sanitary waste disposal, and/or stormwater and fire suppression water runoff.

Potential accidental spills of hydrazine fuel are controlled by spill containment structures that are part of the fueling equipment (see also discussion in Section 3.2). Hazardous chemicals and materials are stored and used in accordance with Air Force handling and safety procedures (see discussion in Section 5). Any spills would be handled in accordance with the Safety Plan for Bldg 1555 (OSC, in preparation) and no adverse impacts on water quality from spills are expected.

Sanitary waste is discharged into the existing septic system at Bldg 1555. This system is being upgraded and expanded as part of the modifications to the facility (OSC, 1993b). The addition of the temporary personnel for satellite processing has been considered in the sanitary facilities upgrade. The resultant facilities will be more than adequate for the needs of the STEP M1 processing.

Discharge of stormwater and/or fire suppression water may adversely effect water quality, since residues present on impervious surfaces can be picked up in the runoff. All processing activities at Bldg 1555 occur indoors, so stormwater runoff would not be able to pick up processing residues. Fire suppression water used at Bldg 1555 would be routed to the existing aboveground storage tank. Normal carrier aircraft and launch operations at the Hot Pad and airfield are not expected to generate any launch site residue (OSC, 1993b). However, a catastrophic accident at either the Hot Pad or airfield may result in contaminated residues being picked up in the runoff from fire suppression water. The likelihood of a catastrophic accident involving the STEP M1 is considered remote or extremely remote (see discussion in Section 5), and any associated adverse impacts

would be unavoidable. Due to the remote potential for a catastrophic event at either the Hot Pad or airfield, no adverse impacts to water quality from stormwater and/or fire suppression water runoff are expected.

4.2.8 Natural Resources

The proposed action will not result in any changes in land use on this portion of VAFB. Oil and gas reserves represent the most important commercial mineral resources at VAFB. The proposed action will not affect these resources.

4.2.9 Energy

The energy requirements of the STEP M1 project are considered minimal. They are readily available from local supplies, and will not affect the availability of energy for national security and other users.

4.2.10 Visual Resources

Transportation, processing, and integration of the satellite will not alter the visual environment around Bldg 1555.

SECTION 5

SAFETY AND RISK ANALYSIS

SECTION 5

SAFETY AND RISK ANALYSIS

5.1 SAFETY

Safety reviews are required for any program on Vandenberg Air Force Base (VAFB). Reviews apply to the satellite, its experiment payload, support equipment, and facilities. The safety review procedure provides the means of substantiating compliance with program safety requirements, and encompasses all system safety analyses and testing as required by Department of Defense (DOD).

The Space Test Experiments Platform Mission 1 (STEP M1) System Safety Program is being conducted in accordance with the Space Test Experiments Platform System Safety Program Plan (TRW, 1990). This plan has been prepared to evaluate system safety requirements, hazard analyses, and system safety data of the program. It provides a description of the system safety management system, including responsibilities, milestones, and means of implementing system safety criteria. Other applicable safety compliance documents include:

- MIL-STD-882C, System Safety Program for Space and Missile Systems
- Western Range Regulation WRR 127-1
- MIL-STD-1522A, Standard General Requirements for Safe Design and Operation of Pressurized Missile and Space Systems
- MIL-STD-1576, Electro Explosive Subsystem Safety Requirements and Test Methods for Space Systems
- CSTC Regulation 127-1, Space Test Safety
- MIL-STD-454L, Standard General Requirements for Electronic Equipment
- DOD-E-83578A, Explosive Ordnance for Space Vehicles, General Specifications

5.1.1 Processing

After the satellite is received at VAFB, it will be transferred to the Vehicle Integration Facility (Building 1555) for final processing. Processing operations conducted at VAFB include final pre-launch testing and fueling operations (see discussion in Section 2.3.2). Processing safety has been considered in the system safety program for the STEP M1, the Vehicle Integration Facility Safety Plan (OSC, in preparation), and the Environmental Assessment for the modifications at the Vehicle Integration Facility (OSC, 1993b). Safety concerns regarding satellite processing operations can generally be divided into injury to personnel and damage to the space vehicle, with the possibility that some accidents could damage subsidiary facilities. These concerns are discussed in Section 5.2, Risk Scenarios.

The satellite, experiments and associated ground support equipment designs have been reviewed to ensure compliance with safety standards (DSI, 1993). System safety inputs and reviews of operational procedures are ongoing as the documentation for plans and procedures is prepared.

5.1.2 Space Debris

Space debris is generated by manned and unmanned space programs. While meteoroids are a source of naturally occurring orbital debris, they are not considered to be a serious hazard due to their essentially consistent population, transient nature through the near-Earth environment, larger volume of occupied space and generally predictable population for spacecraft design (Baker, 1989). Since the launch of Sputnik over 30 years ago, there has been in excess of 7,500 mission-related objects deposited in outer space. In 1987, there were more than 7,000 trackable objects in orbits from a few hundred kilometers (km) out in space to many thousands of kilometers. This space debris poses the greatest hazard to human activities in manned and unmanned programs in outer space. Collisions with space debris could cause varying degrees of damage. Slow degradation of spacecraft capability could occur, due to pitting or fracturing of optical surfaces, solar cell cover glasses or special thermal coatings. In addition, launching upper stages with solid-propellant rocket motors could place clouds of small to large particles that could erode spacecraft surfaces passing through the cloud at high velocities.

While the concerns of space debris and their effects are now being designed into spacecraft, there is valid concern over the safety and related issues with space debris reentering the earth's atmosphere and potentially impacting the earth. Historical data shows that some satellite pieces can survive the harsh environment of reentry into the earth's atmosphere. Well-known examples include the Russian Kosmos 954, which scattered pieces in northern Canada in 1978, and the National Aeronautics and Space Administration (NASA) Skylab satellite, which fell in Australia in 1979. The reentry issue is of importance since legal precedence on international liability for the consequences of damage and cleanup has been set with the January 1978 burn up and disintegration of the Soviet Kosmos 954 satellite (Baker, 1989). The Kosmos 954 was an ocean surveillance satellite containing a nuclear power source fueled by about 50 kg of uranium that burned up in the atmosphere and disintegrated in the Great Slave Lake region of northern Canada. Of the refuse recovered, all but two pieces were radioactive, some of them lethally so.

The design of the STEP M1 mission is to maintain a useful orbit of the satellite for about six to twelve months, after which the satellite will reenter the atmosphere. This design is consistent with the U.S. Space Command (USS PALECOM) Regulation 57-2, which implements the policy of minimizing the impact of space debris on military operations (USAF, 1993c). According to this regulation, "design and operation of DOD space tests, experiments, and systems will strive to minimize or reduce accumulation of space debris consistent with mission requirements". The design of STEP M1 helps to

remove the satellite from space after the mission is complete but also introduces the potential for problems associated with the reentry. The reentry of vehicles has been studied by the Air Force (USAF, 1993b), and a number of factors that affect satellite breakup were identified. These factors included:

- Surface material of the satellite;
- Vehicle attitude during reentry;
- Vehicle size and shape;
- Reentry flight path angle;
- Reentry velocity; and
- Vehicle construction characteristics

Through tests that were performed in the Vehicle Atmospheric Survivability Tests and the Vehicle Atmospheric Survivability Project, additional information was gained on the breakup and trackability of satellites. The results of the tests on these satellites showed initial minor fragmentation starting about 45 to 49 nautical miles (nm) altitude (83 to 90 km), with the final major breakup occurring at around 42 nm (78 km).

The breakup of the STEP M1 satellite is assumed to occur when sufficient thermal energy has been transferred to melt the spacecraft. This thermal energy is derived from the frictional heating that occurs at high speed when the satellite reenters the earth's atmosphere and encounters drag due to increased atmospheric density. Once the outer shell of the satellite has reached its melting temperature and broken up, interior components will be exposed to the flow and rapidly begin to heat up and disintegrate as melting temperatures of the interior components are achieved.

An initial analysis of the reentry and breakup was performed to assess the survival potential of the satellite, or any of its components (Aerospace, 1991). A subsequent analysis based on refinement of the orbital characteristics and satellite weight was then performed to determine if the original analyses were still valid. The results of the analyses predicted a primary structure breakup at about 45 nm (83 km) with the titanium fuel tank surviving the reentry intact, or in several large pieces, if there is structural failure due to loading. Given the fuel tank will survive reentry, there is concern of safety when it impacts the earth. The titanium fuel tanks are of the same general characteristics as those that are flown regularly by numerous programs. Although the risk was not quantified in their re-entry analysis, Aerospace (1991) concludes that the probability of personal injury or property damage is so low that the hazard is taken as part of the accepted risk for the program. The U.S. Air Force, Space and Missile Systems Center has accepted the STEP M1 Program risks.

5.2 RISK SCENARIOS

An Accident Risk Assessment Report (ARAR) has been prepared for the STEP M1 (DSI, 1993). A Test Operations Risk Assessment is included in the ARAR. Subsystems associated with the satellite, its experiments, and related ground support equipment were analyzed to identify potential design and operational hazards. These primary hazards may result in accidents that affect personnel, the satellite, and/or other property. Potentially hazardous subsystems include structural, ordnance, pressurized/propulsion, radiation-producing, and electrical. The subsystems and associated hazards are summarized below.

The satellite structure consists of modules bolted together to form the vehicle. Primary hazards identified include structural failure from stress corrosion and inadvertent deployment of antennas or panels.

The ordnance subsystem consists of pyrotechnically activated bolt cutters, line cutters, and pin pullers, which are used to initiate deployment of solar panels, antennas, and booms. Testing of the ordnance will be conducted during processing at VAFB. Primary hazards identified with the ordnance subsystem include inadvertent firing and structural failure of ordnance housings when fired either accidentally or during testing.

Pressurized subsystems of the satellite include the heat pipe portion of the thermal control subsystem and all major mechanical components of the propulsion system. The propulsion subsystem includes the propellant tank, fill-drain valves, temperature sensors, pressure transducer, filter, pyro isolation valve, dual solenoid thruster valves, and associated plumbing which connects these components. Ground support equipment for these subsystems are associated with the fueling, defueling, and pressure testing of the propulsion system. They are contained in a portable service cart utilized for fueling of the satellite. Primary hazards identified include leakage of liquid hydrazine fuel and accidental activation of thrusters.

Radiation-producing components of the satellite include a 1.6-microcurie solid chip of Radium 226 sealed within an impervious structure on the Satellite Electrostatic Triaxial Accelerometer (SETA) experiment. Additionally, the telemetry transmitter located within the core module of the satellite can radiate at power levels up to 5 watts, with a nominal frequency of 1.8 Gigahertz. During launch site testing, personnel are cleared from an area within 3 feet of the space vehicle, and dummy loads are incorporated at each antenna location to terminate transmitter output before antenna hook up. Radiation exposure from these components is a potential hazard.

The electrical power subsystem of the satellite consists of three 28-volt NiCd rechargeable battery packs, which provide power to the electrical and electronic components. Electrical ground support equipment is also used for operation, testing and diagnostic work on the satellite. Potential hazards include short circuits of the battery pack(s), leakage of potassium hydroxide battery electrolyte, and electric shock.

5.2.1 Injury to Personnel

Accidents and resultant injury to personnel may be related to hazardous materials used in the satellite, experiments, and ground support equipment, and/or primary hazards inherent to the design of the satellite and associated ground support equipment. The hazards identified in the ARAR which may result in injuries to personnel are summarized in Table 5-1.

Table 5-1

Potential Injuries to Personnel

Potential Injury	Cause(s) of Accident
Collision with accidentally released antennas or panels	Activation of release devices due to electromagnetic interference or personnel error
Burn or blast while handling accidentally activated ordnance	Improper handling of ordnance which is not connected to firing circuitry Inadvertent firing by accidentally removing designed inhibits
Burn from release of hot gases	Structural failure of electro-explosive device housing to contain gases when accidentally activated
Exposure to leaked hydrazine fuel	Improper attachment of fueling line to fill drain valve Previously undetected fueling system leak Failure of pressurized valves or joints on the satellite under mechanical or thermal stress Mechanical failure of propulsion system pressurized components Undetected buildup of vapors after shroud installation
Burn or blast from an explosion	Accidental activation of satellite propulsion system
Illness from radiation exposure to the 1.6 microcurie chip of Radium 226 (ionizing radiation)	Unauthorized disassembly of internal satellite components Debris recovery after catastrophic fire or accident
Long-term illness from radiation exposure to excessive Radio Frequency radiation (non-ionizing radiation)	Improper operation of ground support equipment during satellite functional testing
Burn from uncontrolled short circuit of 28-volt battery pack	Intrusion of conductive foreign object, such as a screwdriver, into active satellite electronics
Chemical burn or eye damage from leaking of potassium hydroxide battery electrolyte	Defective battery case Defective battery internal construction
Electric shock	Malfunctioning or improperly grounded ground support equipment

Source: DSI, 1993

5.2.2 Damage to Space Vehicle

Primary hazards inherent to the design of the STEP M1 satellite and experiments were identified in the ARAR (DSI, 1993). Accidents which may result in damage to the satellite are summarized in Table 5-2.

Table 5-2
Potential Damage to the STEP M1 Satellite

Potential Damage	Cause(s) of Accident
Collision impact after unexpected release from hoisting sling or collapse during launch operations	Structural failure of one or more components under hoisting or launch loads
Collision damage to solar cells on accidentally released panels	Activation of release devices due to electromagnetic interference or personnel error
Fire and/or explosion from release of hot gases (in a flammable environment only)	Structural failure of electro-explosive device housing to contain gases when accidentally activated
Contamination with leaked hydrazine fuel	Improper attachment of fueling line to fill drain valve Previously undetected fueling system leak Failure of pressurized valves or joints on the satellite under mechanical or thermal stress Mechanical failure of propulsion system pressurized components Undetected buildup of vapors after shroud installation
Destruction from an explosion	Accidental activation of satellite propulsion system
Electrical harness fire from uncontrolled short circuit of 28-volt battery pack	Intrusion of conductive foreign object, such as a screwdriver, into active satellite electronics
Corrosion to satellite hardware from leaking of potassium hydroxide battery electrolyte	Defective battery case Defective battery internal construction

Source: DSI, 1993

5.2.3 Damage to Structures

Some of the primary hazards identified in the ARAR (DSI, 1993) have the potential to result in damage to property or structures. These hazards are inherent to the satellite materials, design, and operation. Potential damage associated with these hazards is summarized in Table 5-3.

Table 5-3
Potential Damage to Property and Structures

Potential Damage	Cause(s) of Accident
Collision of accidentally released antennas or panels with test equipment	Activation of release devices due to electromagnetic interference or personnel error
Fire and/or explosion from release of hot gases (in a flammable environment only)	Structural failure of electro-explosive device housing to contain gases when accidentally activated
Fire from leaked hydrazine fuel	Improper attachment of fueling line to fill drain valve Previously undetected fueling system leak Failure of pressurized valves or joints on the satellite under mechanical or thermal stress Mechanical failure of propulsion system pressurized components Undetected buildup of vapors after shroud installation
Fire and/or explosion	Accidental activation of satellite propulsion system

Source: DSI, 1993

5.3 RISK ASSESSMENT

Material, design and operational hazards identified in the ARAR have the potential to result in accidents which injure personnel, damage the satellite, and/or damage property and structures. Risks associated with these hazards are addressed in this section. Risk assessment involves categorizing hazards according to their severity and probability of occurrence. These are described below.

5.3.1 Severity

The severity of a hazard or risk is classified by the extent of injury or damage from an accident. Table 5-4 details the categories used to describe hazard severity.

Table 5-4
Hazard Severity Categories

Category	Classification	Description
I	Catastrophic	May cause death or system loss
II	Critical	May cause severe injury, severe occupational illness, or major system loss
III	Marginal	May cause minor injury, minor occupational illness, or minor system damage
IV	Negligible	Will not result in injury, occupational illness, or system damage

Source: DSI, 1993

5.3.2 Probability

Hazard probability is expressed qualitatively. It is defined as the likelihood that a hazard will occur. The six levels of probabilities are listed in Table 5-5.

Table 5-5
Hazard Probability Categories

Potential Occurrence	Level	Description
Frequent	A	Likely to recur, and may be continuously experienced.
Reasonably Probable	B	Likely to occur several times.
Occasional	C	Likely to occur sometime.
Remote	D	Unlikely to occur, but possible.
Extremely Remote	E	Probability of occurrence cannot be eliminated to zero. It can be assumed that this hazard will not be experienced.
Impossible	F	Physically impossible to occur.

Source: Modified from DSI, 1993

5.3.3 Assessment of Risks for Primary Hazards

Severity and probability of the primary hazards of STEP M1 were assessed in the ARAR (DSI, 1993). Although the consequences of most of the accident scenarios are critical or catastrophic, the probability of each accident occurring is typically remote. Based upon the initial hazard assessments, safety actions for elimination and control of the primary hazards were recommended (DSI, 1993). The safety actions have either been completed or will be implemented during processing procedures. Considering implementation of the recommended safety actions, final risk levels were determined. Table 5-6 summarizes the probability, severity, and final risk level for the identified hazards.

Table 5-6
Risk Assessment for Primary Hazards

Hazard Description	Probability	Severity	Final Risk
Structural failure of satellite components	Remote	Catastrophic	Remote
Inadvertent deployment of antennas or panels	Remote	Marginal	Remote
Inadvertent firing of ordnance	Remote	Marginal	Extremely Remote
Structural failure of ordnance housing	Remote	Catastrophic	Extremely Remote
Leakage of hydrazine fuel	Remote	Catastrophic	Remote
Accidental activation of thrusters	Remote	Critical	Remote
Radiation exposure (ionizing and non-ionizing)	Extremely Remote	Critical	Extremely Remote
Short circuit of battery pack	Remote	Critical	Extremely Remote
Leakage of potassium hydroxide battery electrolyte	Remote	Marginal	Remote
Electric shock	Occasional	Critical	Remote

Source: DSI, 1993

5.4 RISK ANALYSIS

The identified safety concerns have been considered in planning for the STEP M1 mission, including processing, launch, operation, and disposal. Detailed procedures and training for all hazardous processes have been or are being prepared and implemented. They include adequate safeguards, appropriate use of personal protective equipment, and toxic and hazardous materials monitoring. All safety procedures have been or will be reviewed and approved by the STEP M1 System Safety Manager. Satellite processing and launch will be conducted in strict compliance with all applicable safety plans and regulations.

All of the identified primary hazards have a remote or extremely remote potential for occurrence. Therefore, despite the potential for critical or catastrophic accidents, final risk levels are considered acceptable.

SECTION 6

REGULATORY REVIEW AND PERMIT REQUIREMENTS

SECTION 6

REGULATORY REVIEW AND PERMIT REQUIREMENTS

This section presents an overview of the environmental regulatory and permit requirements that may be applicable to the Space Test Experiments Platform Mission 1 (STEP M1) Program. Environmental permit requirements were identified from an analysis of previous Air Force space launch programs and an evaluation of federal, State of California, and local laws and regulations applicable to the program. Provisions of regulations may be jointly administered by federal, state, or local agencies. These requirements are discussed in the following sections for each environmental area. The STEP M1 will be required to comply with all applicable Air Force environmental regulations.

6.1 AIR QUALITY

Operations or activities that result in emission of any air contaminant are regulated by Region IX of the U.S. Environmental Protection Agency (EPA), under the federal Clean Air Act of 1963. Under provisions of the Clean Air Act, the local agency is delegated the authority to administer federal policies and grant permits. The California Air Resources Board is responsible at the state level for mobile sources. The local Air Pollution Control District is the Santa Barbara County Air Pollution Control District (SBCAPCD). SBCAPCD has authority over stationary sources of air pollutants emitted from Vandenberg Air Force Base (VAFB). On July 18, 1991, SBCAPCD signed a Memorandum of Agreement with the Air Force to consider (or classify) VAFB as a single stationary source with regard to air quality issues.

The STEP M1 program utilizes the airborne launch concept. SBCAPCD regulations (Rule 202) allow an exemption for aircraft used to transport passengers or freight. Ground operational activities will utilize active sites where all support equipment exists (i.e., new stationary sources of air emissions will not be installed). The STEP program is designed such that the space vehicle arrives fully integrated and flight certified at the launch site. Vehicle assembly, testing, and payload integration will be accomplished at the subcontractor's facilities in McLean, Virginia. Final vehicle setup (i.e., fuel and pressurant loading) will occur at the existing Vehicle Integration Facility (Building 1555) on VAFB.

Processing and launch of the STEP M1 from VAFB is not anticipated to require any new air quality permits. An exemption under the existing VAFB permit for the propellant transfer operation will be obtained from VAFB Environmental Management (30 SPW/ET) prior to STEP M1 processing. This diminimus emissions exemption will allow the one-time use of the fuel loading cart at Bldg 1555 for the proposed action. Records of processing activities, including isopropyl alcohol use and propellant transfer, will be kept

for verification of the proposed action's exempt status. While not anticipated, if the exemption is not obtained, a Permit to Operate must be acquired for the fuel loading cart from the SBCAPCD. Additional future regulatory requirements resulting from revision to SBCAPCD rules are not expected to affect the proposed action due to it's short duration (i.e. one -time event), and no additional new air quality permits will be required.

6.2 HAZARDOUS WASTE

Handling of hazardous waste from all launch programs requires permits and licenses from federal, state and local agencies. The Resource Conservation and Recovery Act (RCRA) of 1976 delegates the EPA to administer a nationwide program to regulate hazardous wastes from generation to disposal. On the state level, Chapter 6.5 of Division 20 of the California Health and Safety Code and the Porter-Cologne Act water quality control provisions operate jointly in the regulation and issuance of permits for hazardous waste facilities. The California Environmental Protection Agency, Department of Toxic Substance Control administers the state's hazardous waste program and maintains the authorization from the EPA to implement the federal program in California. If an operation involves waste discharge that affects water quality, permits must include any limits or requirements imposed by the Regional Water Quality Control Board (RWQCB). A waste is considered hazardous if it contains substances on the lists of hazardous wastes included in 40 Code of Federal Regulations (CFR) Part 261, and the California Code of Regulations (CCR) Title 22, Section 66680.

Under RCRA regulations, VAFB and its tenant programs are considered a hazardous waste treatment, storage and disposal facility (TSDF) because waste is stored on base for more than 90 days. Therefore, the base must comply with general facility standards and technical requirements established by the EPA and California Department of Health Services (CDHS). At present, a Hazardous Waste Storage Facility is allowed to operate under interim status at VAFB. A revised RCRA Part B permit application package was last submitted by the Air Force to CDHS for approval in April 1993, and is currently still pending. Launching of government payloads would fall under the existing base permitted hazardous waste handling systems.

The California Source Reduction and Hazardous Waste Management Review Act of 1989, commonly referred to as Senate Bill (SB) 14, requires examination of current hazardous waste generating processes for hazardous waste minimization opportunities, and creation of a plan to implement workable alternatives. Any hazardous waste that is treated or recycled on-site and hazardous waste that is manifested for off-site recycling, treatment or disposal are subject to the requirements of SB 14. This would include any dilute hazardous waste streams such as contaminated surface water runoff and hazardous waste streams that are pretreated before being discharged to sewers. Spills of liquid propellants (such as hydrazine) or other hazardous waste generated from emergency response actions would be excluded.

Only final ground processing, including fuel and pressurant loading, and launch of the satellite will occur at VAFB. Bldg 1555 at VAFB is equipped to accommodate processing for the proposed action. The existing system for collecting hazardous waste at Bldg 1555, including the above ground storage tank and associated piping, meet the requirements of 40 CFR 265 Subpart J (hazardous waste tank systems). The fueling cart and processing activities are currently exempt from permit requirements under Titles III and V of the CCR. While these regulations are periodically revised, and future revisions may require permits for processing equipment such as the fueling cart, it is not anticipated that any regulation revisions will take place before implementation of the proposed action.

6.3 WATER QUALITY

6.3.1 Wastewater

The RWQCB, Central Coast Region, administers the federal Clean Water Act amended 1989, and the state Porter-Cologne Act of 1969 for Santa Barbara County. The state issues one discharge permit for purposes of both state and federal laws. Under the state law, the permit is called a Waste Discharge Requirement Under federal law, the permit is called a National Pollutant Discharge Elimination System (NPDES) permit. A NPDES permit is required of all point source discharges of pollutants into surface waters of the United States.

No wastewater generation or discharge from final satellite integration at VAFB is anticipated. Therefore, no wastewater permitting activities will be required.

6.3.2 Stormwater

California and federal stormwater regulations do not include government launch activities (Standard Industrial Classification Codes 9711 and 9661). However, the state has authority to designate these activities if they determine discharges are a threat to United States waters. Due to the airborne launch concept for STEP M1, no such threat is anticipated. No changes in the existing stormwater discharge are expected to be caused by STEP M1. Therefore, no permitting will be required.

6.4 COASTAL ZONE MANAGEMENT

The federal Coastal Zone Management Act of 1972, as amended (16 USC Section 1456(c)), and Section 307(c)(1) with Section 930.34 et seq. of the National Oceanic and Atmospheric Administration (NOAA) Federal Consistency Regulations (15 CFR 930, revised), require that a Coastal Consistency Determination (CCD) be submitted for proposed actions within the coastal zone. Generally, the coastal zone extends from the state's three-mile seaward limit to an average of approximately 1,000 yards inland from the mean high tide of the sea. The purpose of the CCD is to assure that proposed undertakings by federal agencies are consistent to the "maximum extent practicable" with the NOAA-approved state Coastal Management Plan (CMP).

In California, the California Coastal Commission, as lead agency for the CMP, coordinates the evaluation of a determination and develops a formal state consistency response. As stated in 15 CFR 930, federal activities on federal property are excluded from state-designated coastal zones. However, if a federal activity has a direct impact on the state's coastal zone, this activity must be consistent with the state CMP.

The potential launch site for the STEP M1 is located within federal property. The mission does not involve any new construction in the coastal zone, nor will it have any direct impacts on the coastal zone. Therefore, a consistency determination is not required.

SECTION 7

PERSONS AND AGENCIES CONSULTED

SECTION 7

PERSONS AND AGENCIES CONSULTED

The following individuals were consulted during the preparation of this Environmental Assessment.

FEDERAL AGENCIES

U.S. Air Force

Los Angeles Air Force Base, California

Hardy, Capt James	SMC/CULS
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Vandenberg Air Force Base, California

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Romero, Bennie	CES/CEV

National Aeronautics and Space Administration, Hampton, Virginia

Grant, Dr. William B. Senior Research Scientist

STATE AGENCIES

University of California at Santa Barbara, Goleta, California

Thompson, Kevin	Public Information

LOCAL AGENCIES

Santa Barbara County Air Pollution Control District, California

Hallerman, Richard	Air Quality Specialist

City of Lompoc, California

Martin, T.	Principal Planner

Lompoc Unified School District, California

Bommerbach, Donna

SECTION 8

REFERENCES

SECTION 8

REFERENCES

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SECTION 9

LIST OF PREPARERS

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Name	Professional Discipline	Experience	Document Responsibility

9.1 U.S. Air Force

Name	Professional Discipline	Experience	Document Responsibility
Hashad, Adel, P.E. (SMC/CEV)	Environmental Engineering and Management	3 yr. Environmental Management; 7 yr. Space Systems Facilities Management; 25 yr. Hydrologic Facilities, Refineries, Public Works, Industrial Design, and Construction	Technical Project Manager
Montgomery, Lt Col James (AL/OEB)	Bioenvironmental Engineering and Management	20 yr. Bioenvironmental Engineering	Contract Management
Hardy, Capt James W. (SMC/CULS)	Developmental Engineering	2 yr. Developmental Engineering	Technical Review

9.2 Aerospace Corporation

Name	Professional Discipline	Experience	Document Responsibility
Mizera, Paul	Systems Engineering	26 yr. Aerospace Engineering	Technical Review

9.3 Engineering-Science

Name	Professional Discipline	Experience	Document Responsibility
Baxter, Robert	Meteorology	16 yr. Meteorology/Air Quality	Global Climate Change; Stratospheric Ozone; Space Debris
Bissell, Matthew T.	Environmental Science	1 yr. Environmental Science	Document Assistance
Crisologo, Rosemarie S.	Biology/Environmental Engineering	14 yr. Environmental Sciences	Project Manager; Project Description & Alternatives
Gaddi, Elvira V., P.E.	Chemical Engineering	5 yr. Environmental Sciences; 4 yr. Chemical Engineering; 3 yr. Research & Development	Air Quality
Luptowitz, Lisa	Geology/Paleontology	3 yr. Environmental Sciences	Waste Management; Hydrology and Water Quality; Safety and Risk; Regulatory Review; Editorial Review
Rojas, Angelina M.	Publications	19 yr. Document Design; Document Production and Word Processing	Document Coordination and Word Processing

List of Preparers (Cont’d)

Name	Professional Discipline	Experience	Document Responsibility

9.3 Engineering-Science (Cont’d)

Name	Professional Discipline	Experience	Document Responsibility
Sawires, Carleen	Physics/Geology	3 yr. Environmental Sciences	Noise; Public Services and Utilities; Socioeconomics; Natural Resources; Visual Resources
Tran, Bea	Business	1 yr. Technical Writing	Document Coordination
Wong, Herman	Meteorology/Air Quality	17 yr. Air Quality	Air Quality
Wooten, R.C.	Environmental Science	4 yr. Research & Development; 12 yr. NEPA Documentation (EA, EIS); 5 yr. Remedial Investigations/Feasibility Studies	Technical Advisor

APPENDIX A

AIR FORCE FORM AF-813 FOR STEP M1 PROGRAM

APPENDIX B

CONFORMITY DETERMINATION:
EPA FINAL CONFORMITY RULE
40 CFR PART 93 SUBPART B (NOVEMBER 1993)

CONFORMITY DETERMINATION
EPA FINAL CONFORMITY RULE
40 CFR PART 93 SUBPART B (30 November 1993)
Space Test Experiments Platform (STEP) Mission 1 (M1)
Vandenberg Air Force Base (VAFB), California

PURPOSE: The Air Force is required to make a formal Conformity Determination as to whether the Proposed Action, launch of the Space Test Experiments Platform (STEP) Mission 1 (M1) spacecraft from Vandenberg Air Force Base (VAFB), California , complies with the New Conformity Rule of the Amended Clean Air Act.

BACKGROUND: The United States Environmental Protection Agency (EPA) has issued regulations clarifying the applicability and procedures for ensuring that Federal activities comply with the amended Clean Air Act. The EPA Final Conformity Rule, 40 CFR Parts 93, subpart B (for Federal agencies), and 40 CFR 51, subpart W (for state requirements), implements Section 176(c) of the Clean Air Act, as amended in 1990, 42 U.S.C. Section 7506(c). This new rule was published in the Federal Register on November 30, 1993, and takes effect on January 31, 1994.

The new EPA Conformity Rule requires all Federal agencies to ensure that any agency activity conforms with an approved or promulgated state implementation plan (SIP) or Federal implementation plan (FIP). Conformity means compliance with a SIP/FIP's purpose of attaining or maintaining the national ambient air quality standards (NAAQS). Specifically, this means ensuring the federal activity will not: (1) cause a new violation of the NAAQS; (2) contribute to an increase in the frequency or severity of existing NAAQS; or (3) delay the timely attainment of any NAAQS, interim milestones, or other milestones to achieve attainment. NAAQS are established for six criteria pollutants: ozone (O_3), carbon monoxide (CO), particulate matter (PM_{10}), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and lead (Pb). The current ruling applies to Federal actions in NAAQS nonattainment or maintenance areas only.

EPA's Final Conformity Rule applies immediately to all Federal agencies until the applicable state's SIP conformity requirements are approved by EPA.

STATUS: The Proposed Action would be located on VAFB, which is in Santa Barbara County, California. Air quality management in Santa Barbara County is under the jurisdiction of the Santa Barbara County Air Pollution Control District (SBCAPCD). In 1991, the SBCAPCD submitted an Air Quality Attainment Plan (AQAP) to the California Air Resources Board (CARB) for the purpose of presenting a comprehensive strategy to bring the County into compliance with the state ambient air quality standards. Because the CARB is still in the process of integrating similar AQAPs from various counties throughout the state, there is no EPA-approved SIP at this time. As a result, the individual counties, such as Santa Barbara are following federal implementation guidelines.

The area of Santa Barbara County containing VAFB is designated "cannot be classified" for SO_2 and PM_{10}, and "cannot be classified or better than national standards" for NO_2 and CO. The entire Santa Barbara County is classified as "moderate" nonattainment for O_3. The classification of the lead standard has not been determined.

The new EPA conformity rule requires that total direct and indirect emissions of criteria pollutants, including ozone precursors (i.e., volatile organic compounds and nitrogen oxides) be considered in determining conformity. The rule does not apply to actions where the total direct and indirect emissions of criteria pollutants will be de minimis. In addition, ongoing activities currently being conducted are exempt from the rule so long as there is no increase in emissions above the deminimis levels specified in the rule. The de minimis threshold levels in nonattainment areas are shown on Table 1. The de minimis threshold level in Santa Barbara County is 100 tons per year.

Table 1
De Minimis Thresholds in Nonattainment Areas

Criteria Pollutant	Degree of Nonattainment	Tons/year
Ozone (VOCs and NOx)	Serious	50
	Severe	25
	Extreme	10
	Other ozone nonattainment areas outside of ozone transport region	100
VOCs	Marginal/moderate nonattainment within ozone transport region	50
NOx	Marginal/moderate nonattainment within ozone transport region	100
Carbon monoxide (CO)	All	100
Particulate matter (PM_{10})	Moderate	100
	Serious	70
Sulfur/nitrogen dioxide (SO_2/NO_2)	All	100
Lead (Pb)	All	25

Source: 40 CFR 93.153 (b)

SUMMARY OF AIR POLLUTANT EMISSIONS ATTRIBUTED TO THIS PROPOSED ACTION: The emissions of ozone precursors (hydrocarbons and nitrogen oxides) that would result from implementation of the proposed action are shown in Table 2. As shown, the combined emissions from ground support operations, launch rehearsal, carrier aircraft takeoff and landing result in a total of 507.85 lbs, or 0.25 ton, of hydrocarbons and 158.64 lbs, or 0.08 ton, of nitrogen oxides per launch. A total of one launch would occur for the Proposed Action, and this would occur within a single year. This emission total is below the de minimis threshold level of 100 tons per year.

Table 2
STEP M1 Ground Support
and Launch Operations Emissions of Ozone Precursors

Activity	Emissions, lbs/launch HC	NO_X
Ground Support Operations Emissions		
Forklift unloading[a] 0.05	0.44	
Alcohol wipedown[b]	6.57	---
Hydrazine transfer[c]	---	---
Assembly truck transfer[d]	0.08	0.65
Hydraulic lift for attachment	0.15	1.55
Subtotal, Ground Support	**6.85**	**2.64**
Launch Operations Emissions for Rehearsal and Launch		
L-1011 Landing/Takeoff Cycle[e]	498.00	126.00
F-16 Landing/Takeoff Cycle[f]	3.00	30.00
Subtotal, Rehearsal and Launch	**501.00**	**156.00**
Total, STEP M1 Emissions	**507.85**	**158.64**

Source: Engineering-Science
HC hydrocarbons (volatile organic compounds, VOC)
NO_X nitrogen oxides
a Based on 1-hour operation of a diesel-fueled 50-horsepower forklift
b Based on maximum use of 1 gallon of isopropyl alcohol
c Based on a control system efficiency of at least 99 percent
d Based on a maximum 20-mile roundtrip
e Based on EPA AP-42 emission factors and one landing/takeoff cycle each for rehearsal and launch
f Based on EPA AP-42 emission factors

DETERMINATION: The total direct and indirect emissions from the Proposed Action, do not exceed the de minimis threshold for the criteria nonattainment pollutant, and therefore, this Proposed Action is deemed de minimis and exempted from the conformity requirements of the EPA Conformity Rule 40 CFR part 93.153(b) and (c), in accordance with Section 176 (c) of the Clean Air Act, as amended in 1990, 42 U.S.C. Section 7506(c).

POINT OF CONTACT: Comments on this Conformity Determination may be submitted to:

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APPROVED:

HQ SMC Environmental Protection Committee

EUGENE TATTINI
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Date